



Digitized by the Internet Archive
in 2015

MARYLAND & RARE BOOK ROOM
UNIVERSITY OF MARYLAND LIBRARY
COLLEGE PARK, MD.

MARYLAND & RARE BOOK ROOM
UNIVERSITY OF MARYLAND LIBRARY
COLLEGE PARK, MD.

JAN 27 1952

University of Maryland

RESEARCH

Leads the Way to

AGRICULTURAL PROGRESS

Library, University of Maryland
College Park, Maryland

64th Annual Report

Station Bulletin A-67

AGRICULTURAL EXPERIMENT STATION

College Park, Md.

The annual report of the Agricultural Experiment Station is designed to provide Maryland farmers, Extension personnel and other interested people an insight into the nature and scope of agricultural research now receiving study.

The problems confronting agriculture are becoming increasingly complex. The answers can be found only through carefully planned and organized experimentation. At present there are approximately 165 different organized research projects under way. Each is designed to find a solution to a definite agricultural problem.

Every one benefits from the results of agricultural research. All of us use the products of agriculture whether for food, or clothing, or shelter, or for pleasure. Every improvement in quality, in nutritive values, in better yields resulting from new methods of growing or feeding, or through improved methods of disease and insect control ultimately benefits the consumer. The farmer is but one of the links in the chain of beneficiaries.

Grateful acknowledgment is extended to the many public, private and industrial organizations and individuals for their cooperation and support of the research program of the University of Maryland Agricultural Experiment Station.

I. C. Haut,
Director.

**To the Governor of Maryland, the Board of Regents, and the
President of the University of Maryland**

I transmit herewith the Sixty-Fourth Annual Report of the University of Maryland Agricultural Experiment Station, as established by Act of Congress, March 2, 1887, containing an account of research and experiments conducted during the fiscal year ending June 30, 1951, and a statement of the receipts and disbursements for the same period.

**I. C. Haut,
Director**

Contents

	<i>Page</i>
Agricultural Economics and Marketing	3
Production Economics—page 3; Land	
Economics—page 6; Marketing—page 6	
Agricultural Engineering	9
Agronomy	13
Pasture and Hay Crops—page 13; Soils—	
page 20; Grain Crops—page 22; Weed Control—	
page 24; Seed Inspection—page 25.	
Animal Husbandry	26
Beef—page 26; Swine—page 28; Sheep—	
page 28.	
Animal Pathology	31
Botany	32
Plant Diseases—page 32; Plant Breeding—	
page 36; Plant Physiology—page 39.	
Dairy	40
Dairy Production—page 40; Dairy Technology—	
page 43.	
Entomology	46
Horticulture	53
Vegetables—page 53; Fruits—page 58;	
Floriculture and Ornamentals—page 63;	
Processing—page 66.	
Poultry	69
Feeding—page 69; Breeding—page 72;	
General—page 74.	
Rural Sociology	75
Soil Conservation Research	76
Publications	78
Current Projects	81
Changes in Personnel	86
Station Staff	87
Financial Statement	88

Agricultural Economics and Marketing

Just as the economic and social lives of farm people become more and more complex, so do the problems associated with farming become more numerous and complex. Agricultural economists are constantly studying problems in farm management, farm taxation, farm

credit, marketing of farm crops, farm insurance needs, rural roads, farm prices and production trends, and a host of other economic problems. Maryland agricultural economists worked on 29 different projects in these various fields this past year.

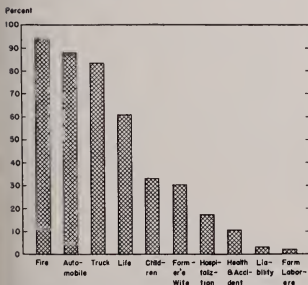
Production Economics

Maryland Farmers Found Low on Insurance

Farming has always been considered a hazardous occupation, both financially and physically. Many farmers have not realized the importance of protecting themselves and their families against unforeseen catastrophies over which they frequently have little or no control. Consequently, a study was undertaken to determine how much protection farm families and farm workers have and to ascertain what factors farmers should consider in evaluating their insurance needs.

Researchers got information on farm insurance in 19 Maryland counties. About 61 percent of the farmers interviewed had some form of life insurance, 87 percent of them carried automobile liability insurance, and 94 percent carried some form of fire insurance. Based on the farmers' estimate of current replacement costs, fire insurance now being carried would have replaced only about 46 percent of the value.

The study showed a real need for farmers to carry more fire and liability insurance to protect themselves and their families from unnecessary hardships in the event of a fire or an accident. (*Project A-18-aa*)



Percentage of Maryland Farmers Carrying Various Types of Insurance

It Pays To Follow Soil Conservation Practices

Conflicting statements appear from time to time as to whether or not it pays to follow some of the recommended soil conservation practices. Economists studied 16 farms in the Harford County Soil Conservation District, eight of which were in the program and eight of which were not. Detailed farm records for the period before the program was started were available.

Most of these farms grew hybrid seed corn. Yields increased about 50 percent on the farms in the program and only 19 percent on those farms not in the program. The animal unit carrying capacity of crop land and pasture was increased 30 percent on the farms in the program and only 9 percent on those not in. This study indicated that mechanical erosion control can increase production and conserve the soil at the same time. (*Project A-18-ab*)

Survey Indicates Grassland Dairy Farms More Profitable

In a study designed to learn which factors affected the efficiency of milk production, and to determine whether or not various grain feeds should be home-grown or purchased, agricultural economists discovered that "grassland" farms had more milk cows per farm and a greater intensity of livestock per acre of cropland than did "grain farms." The results showed that farmers could make more money by farming intensively with dairy cows and buying the needed grain. (*Project A-18-af*)



A low-type improved county road that needs widening.



A road of this type is adequate for most purposes in serving rural communities.

Status of Rural Roads Object of Comprehensive Study

Nearly one-half of the rural public roads need improving to give farmers all-weather service. How to provide them at reasonable costs is a basic rural problem.

Of the 12,000 miles of county roads in Maryland in 1950, 37 percent were earth surface, 28 percent were stone and gravel, 25 percent were of low-type bituminous, and only 10 percent were high-type surfaces. The mileage of earth roads has been reduced by about 2,300 miles during the last 12 years, but much remains to be done.

Differences in road status, needs, and tax resources, indicate that some form of state participation in financing the county road program is justified, and that this program might be accomplished on a state incentive fund aid basis. (*Project A-19-h*)

Farm Building Assessment Techniques Analyzed

Studies were made of assessment techniques, unit rates and trends in the assessment of farm buildings, before

and during the second 5-year assessment rotation.

The taxable basis against farm buildings increased about 51 percent from 1940 to 1950. Building assessment increases represented 83 percent of the farm real estate assessment increases. In 1950, buildings represented 51 percent of the farm real estate assessments, as compared with 43 percent in 1940.

Farm buildings constitute the least productive portion of the farm, therefore, measures of assessment should not place too much emphasis upon farm buildings. (*Project A-19-i*)

State Sales Taxes Found to Vary Widely with the Type of Farming

Several hundred farm schedules for state income tax purposes have been analyzed to determine which farm production expenditures are exempt and which are taxable under the Maryland Retail Sales Tax Law. Preliminary observation of analyses indicates that farms of different type enterprises are affected differently by the sales tax. For example, as much as one-half of the farm operation expenditures on tobacco farms might be subject to the sales tax, whereas only 10 percent of such expenditures on poultry farms would be taxable.

Such differences indicate the desirability for a review of the exemption policy from the standpoint of equality in the application of sales taxes to farmers. It is commonly accepted, however, that to bring about such change would require modifying the whole retail sales tax structure in Maryland. (*Project A-19-j*)

Recent Tax Changes Surveyed

A special study was made in Montgomery County and adjoining counties in which comparisons were made of property tax burdens and assessment rates. This study showed that the 5-

year rotation assessment plan in Maryland produced unequal current tax burdens on similar farm property.

Another phase of this project concerns assessment policies as they affect land use in the rural-urban fringe in Baltimore and Montgomery counties. This phase of the study showed that assessments against farm property in the fringe zone were excessive when related to farm use, and that assessment policies tended to over-anticipate the urbanization of such land.

Farm assessment data show a decided upward trend in farm real estate assessments in most counties. Since 1940 this increase has averaged 26 percent and was as much as 62 percent in Montgomery County. Farm personal property assessments in five counties increased about 60 percent. (*Project A-19-k*)

Farmers Give Opinion of Social Security

In a recent study on farmers' attitudes toward social security, agricultural economists learned that, in general, farmers who opposed a social security program for farmers were in a stronger financial position than those farmers who favored such a program.

The following reasons were offered by farmers as to why farm operators should have social security: (1) give farmers their share of what they are paying for, (2) to provide a certain source of retirement income regardless of economic or other conditions, and (3) to provide a certain source of income for survivors of farm operators. Social security should be extended to hired farm labor for the following reasons, in the opinion of farmers: (1) provide economic security for laborers who may not become farm operators, (2) to make it easier to get and keep farm help, and (3) to provide income to survivors of farm laborers. (*Project A-19-l*)

Data Show More Information About Sources of Farm Credit Would Help Farmers

With constantly rising farm costs comes a need for more agricultural credit. Many farmers who are borrowing money for the first time do not always know where to find the best source of farm credit for a particular purpose.

Agricultural economists recently interviewed several hundred Maryland farmers to determine how much credit was being used and how much was known about available credit agencies extending farm credit. Nearly half of the farmers contacted in this study had

borrowed an average of \$727 from some source during the 1949-50 period. They borrowed an average of \$1,147 during the 1949-50 period, plus using an average of \$618 of merchant credit per farm.

The Production Credit Association or the National Farm Loan Association supplied the credit for 23 percent of those interviewed. Farmers who had borrowed from these cooperatives had a limited knowledge of them, and farmers who had not borrowed from them were not acquainted with them. This study pointed up the need for more information on the sources of farm credit. (*Project A-19-m*)

Land Economics

Public Drainage Problems

When farmers organize public drainage associations to solve a public drainage problem they frequently encounter some formidable obstacles, one of which is financing the operation. A study of these obstacles shows that a number of legal devices are now in operation to help overcome this financial obstacle; the latest device is one granted in 1949 that gives borrowing powers to public drainage associations. (*Project A-32-h*)

Rural Zoning Becoming a Problem in Some Maryland Counties

Rapid expansion of population in urban areas adjacent to large metropolitan areas in or near Maryland is

causing some serious problems. Three counties already have county-wide zoning ordinances: Anne Arundel, Baltimore and Howard. Montgomery, Prince Georges, St. Marys and Wicomico, have ordinances for a portion of the county.

Most of these zoning problems have arisen from about four situations: (1) encroachment of residential subdivisions on agricultural land; (2) commercial development along highways; (3) disposal of sewage; and (4) water pollution. In general, the adoption of zoning ordinances has helped to preserve land values and to reduce the cost of governmental services by controlling the density and distribution of population. (*Project A-32-i*)

Marketing

Retail Merchandising Practices Under Study

Retail merchants are constantly studying and trying to improve their merchandising practices and display methods for fruits and vegetables. Many produce merchandisers recommended peas, lima beans and snap

beans as three vegetables for ice display. Results of this study, however, indicated that using ice on these items tended to increase spoilage losses.

Waste and spoilage losses for fresh produce were lowest in the spring and highest in the winter, partially because fresh produce moved out of the pro-

duce racks faster in the spring than in the winter. Mechanically refrigerated produce racks were the most effective for handling produce.

This study also showed that consumers were exceedingly price conscious. Half of the families visited gave high prices as the reason why they did not trade with the nearby independent stores. The quality of the fruit and vegetables also influenced the housewife's decision as to where to shop. (*Project A-26-r*)

Survey Shows High Quality Maryland Cantaloupes Preferred Over Western-Grown Cantaloupes

In recent years Maryland cantaloupes have had strong competition from cantaloupes shipped in from some of the western states. However, when sample melons with the same sweetness were selected from both areas, consumer preference tests showed that consumers prefer the Maryland-grown cantaloupes. The study also showed that Maryland growers must grow more sweet, high quality cantaloupes if they expect to compete successfully with melons from other areas. It pointed to the need for a quality improvement program and a method of descriptive labelling. (*Project A-26-s2*)

Where Do Peaches Get Damaged Between the Orchard and the Retailer?

Studies were made in the peach marketing season of 1949 to determine where and to what extent the deterioration in peach quality occurred between the orchard and the retail store. Shipments were followed from three areas in Maryland to Baltimore, Washington, Pittsburgh, and New York City. All shipments were made in the conventional bushel basket with the usual face and bulge pack.

Records on 30 shipments showed that 4.5 percent of the fruit was

bruised after picking, 8.5 percent after packing, 16.0 percent in the wholesale markets, and 27.5 percent in the retail markets. In a comparison of 10 shipments each in bushel baskets and field crates, there was three times more damage to peaches shipped in baskets than to those in the field crates. (*Project A-26-w*)

Analysis Made of Seasonal Versus Uniform Milk Production in the Baltimore Milkshed

Milk consumption is relatively uniform throughout the year, but production varies seasonally. An increasing variation in seasonal milk production has created problems of concern to the dairy industry. As a result of this, economists studied the operations of two groups of dairymen in the Baltimore Milkshed, one group with a rather uniform production of milk, and the other with a highly seasonal production pattern.

On the farms where milk production was fairly uniform more land was devoted to permanent pasture and less to crop land; the production per cow was 17 percent higher; 65 percent of all cows freshened in the last half of the year; and in general better herd management, breeding practices and use of farm resources were evident. (*Project A-26-t*)

Price in Relation to Egg Quality Determined

A study of factors affecting the production of high quality eggs showed that farmers who sold quality eggs during the summer months got 5 cents more per dozen than those who sold low quality eggs. The added cost of maintaining high quality eggs is relatively small, the greatest being the additional time required to gather eggs more frequently. (*Project A-26-v*)

FIG. 1: PERCENT OF BROILERS SHIPPED FROM DELMARVA
TO VARIOUS STATES - OCT 1949 - OCT 1950



Where Do Egg Producers Sell Their Eggs?

A majority of all flock owners in this study sold their eggs to hatcherymen, with sales to hucksters and wholesalers next in importance. Eggs sold direct to consumers brought the highest price; hatcherymen paid the second highest price, with hotel and restaurant operators next. (*Project A-26-aa*)

Studies Determine Range of Broiler Marketing and Distribution

Production of broilers in the last 10 years in the Delmarva area has increased 143 percent. These broilers are marketed in 37 different states. Almost 50 percent of the total production was marketed in New York, with Illinois, Pennsylvania, New Jersey, Nebraska and Virginia receiving sizable quantities. Recent expansion of other broiler areas and development of new

areas are giving the Delmarva area some market competition.

Broiler processors indicated that northern markets purchased heavier birds than southern markets. Approximately three-fourths of a group of housewives in Baltimore, Trenton, New Jersey, and New York City preferred fresh chicken to frozen. (*Project A-26-ac*)

Other studies conducted by agricultural economists include "Competition in the Marketing of Potatoes," "Marketing Premium Sweet Corn Direct From Grower to Retailer," "Prices Paid for Commodities Bought," "Farm Tenancy and Leasing Arrangements," "Marketing Maryland Wheat," "Pricing Policies in Retail Stores," "Marketing and Distributing Maryland Canned Vegetables," "Father and Son Partnership Arrangements," and "Marketing Spinach and Kale in Consumer Packages."

Agricultural Engineering

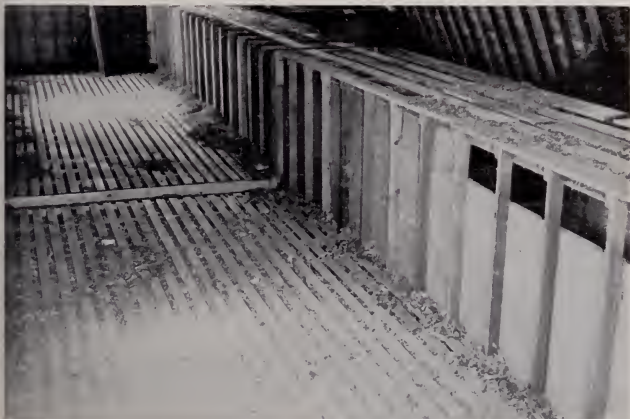
The Experiment Station's agricultural engineers continued their work on developing various types of machines and equipment designed to improve the production and harvesting of agricultural crops, and to increase the effi-

ciency of farm labor. They are currently working on such things as air driers for hay and corn, a tobacco spearing machine, and a machine for applying insecticides to sweet corn.

Studies on Mow Curing of Hay Reveal Better Practices

In a recent survey agricultural engineers conferred with approximately 70 farmers on mow curing systems and their management. In all cases farmers were convinced that mow curing their hay was paying them dividends by enabling them to harvest more hay in less time, reducing the amount of grain and concentrates fed to cows because of a higher quality hay, and by reducing the labor requirements. In addition high losses during bad weather are eliminated by mow curing.

The management of the entire haying system is very important in mow curing hay successfully. Research findings show that for best results the hay should be at about 35 to 40 percent moisture content when placed in the mow. Also, keeping the hay uniform in the swath, reducing "piling-up" when raking, keeping conditions uniform when removing from field and placing in the mow, and operating the fan continuously have all proved to be important considerations in getting the best quality hay regardless of weather conditions. (*Project R-14*)



A typical farm hay drier installation.

Findings Show Drying Partially Field Cured Baled Hay with Heated Air is Profitable

Maryland dairymen with large operations have had trouble getting large hay crops harvested without some weather damage or some spoilage in the mow, unless some form of artificial drying was used. Mow drying with unheated air takes too much time and therefore is not satisfactory for the large crop. Tests have shown, however, that it is possible to dry 10 tons of baled hay with as much as 40 percent moisture content in two days with heated air, whereas it takes from two to three weeks to dry the same amount of hay with unheated air.

Since drying with heated air is relatively expensive for small amounts of hay, a farmer must harvest at least one hundred tons of dry hay each season to recover the cost in added feed value. Records show a cost of approximately five dollars per ton for fuel to dry 225 tons of hay during one season. This cost is recovered by increasing the quality of the hay as proved by a feeding trial conducted cooperatively with the Dairy Husbandry Department.

In this trial hay cured in the barn with heated air and field-cured hay were taken from the same field. The following analysis lists the digestible portion of these hays:

	Barn-Cured Alfalfa Hay (Heated Air)	Field-Cured Alfalfa Hay (Rained on once)
Dry Matter.....	55.8%	50.5%
Protein	12.4%	11.4%
Fibre	14.2%	15.2%
Nitrogen Free Extract.....	26.7%	19.5%

More digestible dry matter, protein and nitrogen free extract are available in the barn-cured hay. The higher digestible fibre contained in the field-cured hay is offset by the increase in amount of energy required to digest the additional amount of crude fibre.

Comparing the actual feeding values of the two hays, the barn-cured hay had 44.3 percent more net energy available for the actual production of milk than the field-cured hay. Thus the farmer who produces a large hay crop will have lower overhead and operating costs with a heated air dryer. Hay can be dried at a profit since grain consumption can be reduced and no hay is lost through unfavorable weather conditions. (*Project R-10*)

Engineering Problems Related to Production, Harvesting, Curing and Storing Maryland Tobacco

The tobacco spearing machine constructed in the Agricultural Engineering shop was tested and very satisfactory results were obtained. This unit will spear and space uniformly six plants of tobacco on a 4½ foot tobacco stick. Some tobacco leaves were bruised and minor mechanical failure of some of the parts occurred, but the machine has been rebuilt to correct these difficulties. The unit was operated by two men who averaged three sticks of tobacco speared per minute.

Studies on the hanging of tobacco mechanically are in their second year. Angle iron racks have been constructed and an electric hoist installed in the test tobacco barn. Results indicate that this system would not be economical for most farmers and work is being done on a more economical system.

Tests were started this year on the use of heat to grow tobacco plants. Hot air, underground soil cable, and above ground soil cable were used. Plastic and regular cotton covers were used. The object of the test is to determine the effect on the plants and obtain information on soil temperature with each type of heat. Field tests are being made to note possible effects on the plants in the field such as early flowering and total growth of plant.

The second year's test with supplemental heat and forced air to control



The tobacco spearing machine in operation.

the curing during high humidity weather was made last season. Very good curing conditions were maintained with a 2,000 C.F.M. (cubic foot per minute) capacity fan blowing hot air from a 75,000 BTU/hr. oil heater through the 24' x 36' barn. This gave a temperature rise from 6° F. to 12° F. inside the barn and kept the relative humidity below 85 percent which is the critical point. Observations indicate a very good cure; grading has not been done to date. Tobacco cured in the experimental barn and marketed in 1950 brought an average price of 30% above the state-wide average. (Project R-11)

Studies Started on Drying Ear Corn with Unheated Air

When the corn picker was introduced into Maryland a large amount of wet corn was harvested, because corn harvested by picker early enough to permit timely sowing of wheat in the

common rotations is too high in moisture content for safe storage in ordinary cribs. Drying with unheated air requires a minimum investment in equipment. This project was started in 1950 to determine whether such drying is effective under Maryland climatic conditions.

The work of the first year, with weather neither extremely wet nor extremely dry, indicated that:

1. Clean ear corn of 30% moisture can be dried satisfactorily at depths of 5

Bins used in corn drying experiment.



to 15 feet when 10 C.F.M. (cubic feet per minute) or more of air per bushel are blown through the corn.

2. Some mold developed in the upper third of a bin where only 5 C.F.M. of air per bushel was supplied.
3. Depth of corn up to 15 feet did not affect the drying rate so long as the C.F.M. per bushel was the same.
4. Cost of drying increases with depth because both the velocity and distance of travel of the air increase, thus requiring more power per cubic foot of air moved.
5. Water was removed from the corn even during rainy weather in the early stages of the drying process.

Additional work is required to determine the effect of: annual variations in weather, husks, silks and loose corn, and operating the fan during dry weather only. (*Project R-12*)

Equipment Being Developed to Apply Insecticides to Canning Corn for Control of European Corn Borer

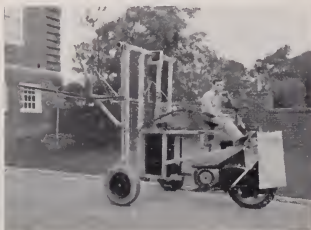
Sweet corn processors have been reporting losses in the corn itself because of extensive ear damage caused by the European corn borer. USDA and the University of Maryland agricultural engineers are developing machines that will apply insecticides to sweet corn under field conditions.

Two self-propelled machines have been developed with basically similar features.

Both machines were tested on 500 acres of sweet corn planted on fairly level ground under similar conditions, near Easton, Md. Both machines were satisfactory. Reduced worm damage increased the daily canning plant output, in some instances up to 100 percent by reducing the amount of trimming, increasing worker output and increasing "cut-off" per ton. The machine built by USDA has certain design features that are definitely preferred. Due to the lack of traction in ruts, gulleys and soft or wet fields, the single wheel drive machine failed to operate satisfactorily. In these same conditions little difficulty was encountered with the rear wheel drive machine. Due to steering methods used the USDA machine was more easily operated at high speeds.

The following principles should be used when building a machine of this type: two-wheel drive, separate clutch for pump unit, large tank capacity, low field speed (3 m.p.h.) and high road speed (12 m.p.h. or over), low center of gravity for stability, minimum of 5 ft. clearance of frame, and easily adjusted and controlled spray booms.

These machines are now being tested on rolling ground in central and western Maryland. (*Project R-13*).



Left, the University of Maryland machine; right, the USDA machine.



One of several groups attending Agronomy Field Day to view research work in progress. A comparison of alfalfa varieties in third year of production is here being observed.

Agronomy

The agronomy research staff is working closely with researchers in several other departments in the Experiment Station's integrated program to improve Maryland's agriculture. Important contributions in this field are being made.

In the search for pasture and forage crops that will better meet the feed needs of Maryland livestock, several new and highly productive varieties of legumes and grasses have been tested, their place in a balanced feed production program determined, and they are now in general use on Maryland farms. Maryland agronomists have also worked with agronomists from nearby states to test the adaptability of various varieties of these forage crops.

A great deal of experimental work is being done with soils, fertility levels, fertilizer and limestone application rates for different crops. Also, many trials have been run on grain crops to find the most productive varieties.

Rapid strides have been made in the production practices used with tobacco, the important crop of southern Maryland. Several chemicals have been tested for weed control in corn and other crops.

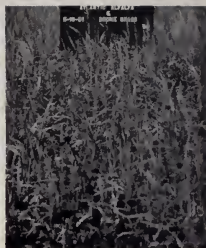
Research agronomists are continuing their search for better practices and crops to help make Maryland agriculture more productive and profitable.

Pasture and Hay Crops

Varieties and Strains Under Extensive Test

Researchers in Agronomy have joined forces with other Experiment Station workers in several Northeastern states to study the important species, varieties and strains of forage plants that are available for pasture and hay production. Realizing that the value of these grasses and legumes is not bounded by state lines, these researchers

picked seven locations in the Northeastern United States to run similar tests. The locations were selected to represent the main soil and climate variations that exist in the region. The trial in Maryland is located at the Plant Research Farm near College Park. Similar tests that will apply to parts of Maryland are located in West Virginia, Pennsylvania, and New Jersey. Varieties and strains of Ladino



The addition of a compatible grass with an adapted variety increases yields and improves curing for hay. Note the increased height of Atlantic alfalfa when grasses are added.

clover, birdsfoot trefoil, alfalfa, red clover, orchard grass, timothy, and brome grass are being compared. The first full year of yield results at Maryland were collected during the 1950 growing season. (Project B-56-f)

Birdsfoot Trefoil Not Too Promising in Maryland

This legume is filling an important place in New York State and in other

areas north of Maryland; however, all of the varieties of birdsfoot trefoil tested proved disappointing at College Park. This is in agreement with previous tests in the state which have shown it to be less productive than the hay and pasture plants now in general use. (Project B-56-f)

Several Alfalfa Varieties Show Promise in State-wide Testing

Differences among the various alfalfa varieties were not great in this first year of harvest. The yields were as follows:

Variety	Yield in Tons Per Acre—Hay Dry
Narragansett	2.67
Atlantic	2.50
A 225	2.47
Williamsburg	2.42
Grimm	2.39
Buffalo	2.33

(Project B-56-f)



Brome grass varieties differ greatly in forage production under Maryland conditions

In another series of tests, ten varieties of alfalfa were established at four locations in Maryland in 1948 and were harvested during 1950, their second harvest year. Third harvest year results were obtained from another location for eight of these varieties.

Williamsburg, Atlantic, and A 225 (Northern Synthetic variety) were superior in yields in northwestern Maryland. Williamsburg, Atlantic, Kansas common, and Buffalo were promising for the north central and central portions of Maryland. Williamsburg and Atlantic appear most promising for the Eastern Shore area. (*Project B-56-d*)

Red Clover and Grass Varieties Differ Significantly

Kenland and Pennscott were superior in yield among the red clover varieties tested. The Beltsville strain of orchard grass was superior to commercial seed. The production from commercial seed of timothy was superior to the varieties Lorrain, Hopkins, Marietta, and Milton although production from all varieties was low after the first cutting. The following results were obtained from the brome grass comparisons:

Variety	Yield in Tons Per Acre—Hay Dry
Achenback	2.01
Lincoln	1.93
Manchar	1.88
Fischer	1.80
Martin	1.66
Northern Commercial..	1.32

(*Project B-56-f*)

Pasture Renovation Studies Reveal Improved Methods

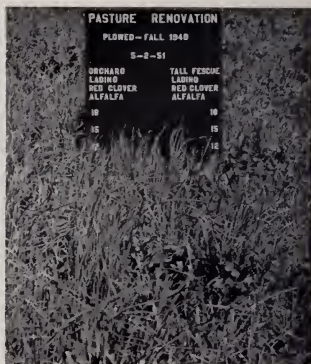
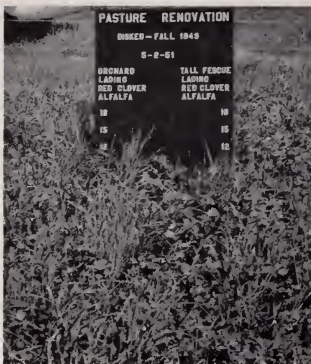
Maryland farmers are constantly in need of pastures that will produce more per acre, and particularly pastures that will be productive during mid-summer. Research work at the Maryland Station has shown that tall-growing pasture mixtures composed primarily of Ladino clover with a tall-growing grass, such as orchard grass, best meets these needs. Kentucky bluegrass is often unproductive during hot, dry periods of the mid-summer. Because large acreages of Kentucky bluegrass are

now being used in Maryland as permanent pasture for livestock in the state, farmers face the problem of how to replace part of the acreage of bluegrass in these pastures with tall-growing plants. Pasture renovation studies were begun in the spring of 1947 to study the variables associated with fall versus spring establishment, disking versus shallow plowing, and a number of grass and legume mixtures.

In 1950 comparative yields showed that orchard grass or tall fescue in combination with Ladino clover, red clover, and alfalfa produced the most dry matter per acre. The addition of red clover and alfalfa to the orchard grass-Ladino mixture considerably increased yields in the first and second harvest years. Considering all of the grass and legume mixtures used, the new seedings became established better with fall seeding than with spring seeding. This was true on areas which were shallow plowed as well as areas which were disked. From the standpoint of destroying the original sod, disking was just as successful as plowing for fall seedbed preparation, while plowing was superior to disking in spring preparation of the seedbed. All mixtures with birdsfoot trefoil were failures in comparison to the other legume used. (*Project B-56-b*)

Pasture Mixtures Best Suited for Beef Production Studied

Most pasture plant comparisons must be made by clippings because of the large land areas and high cost that is involved when the value of these plants is determined on a basis of beef or milk production. However, in any well-rounded program there is need for some comparison of these mixtures on a basis of their utilization by livestock. In the Maryland research program the mixtures that look most promising under observation and clipping trials were selected for comparison by actual grazing. Thus far beef cattle have been used to compare the value of these mix-



Disking (left) started in early July proved as satisfactory as shallow plowing (right) in killing unproductive sods preparatory to August pasture seedings. As shown, resultant stands on disked areas usually contain a higher proportion of legumes.

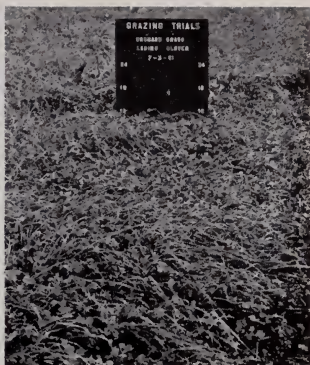
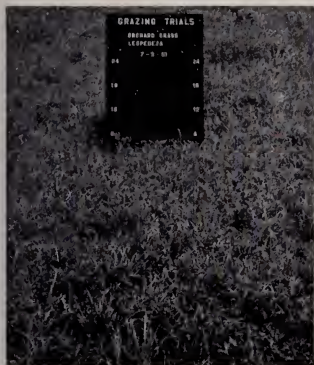
tures. The information gained should be of value to all livestock producers.

In 1950, following establishment of these mixtures in the late summer of 1949, a hay crop was made followed by seven weeks of grazing. During the period of July 10 to August 28, Hereford yearling steers were grazed rota-

tionally on the various mixtures. Beef cattle gains in pounds per acre were as follows: Orchard grass-Ladino clover mixture, 118; tall fescue-Ladino clover, 101; Kentucky bluegrass-timothy-white clover, 91; smooth brome grass-Ladino clover, 87; orchard grass-lespedeza, 82. (Project B-56-j)



Beef cattle grazing on orchard-Ladino mixture in experimental trials at tobacco research farm.



The associated legume has an important effect on yield of a grass. These areas were seeded at the same time and were given the same grazing. Note the short growth of orchard grass-Korean lespedeza, and tall growth of the orchard grass-Ladino clover.

Red Clover Stands Can Now Be Maintained

During the past five years, Maryland farmers have experienced unusual difficulties in maintaining red clover stands during the summer and winter following the combining of small grains. In most cases the stand of clover was adequate at the time the small grain was combined, but was too thin to make a good hay yield the following year. When this problem came to the attention of agronomists, a project was started to study ways in which red clover stands could be maintained. This work has been completed, after three years of study of research plots located in the Coastal Plain and Piedmont areas.

One of the most important findings in this study is that the red clover growth, and any weeds that occur with it, should be grazed or cut during the seedling year if stands are to be maintained. Studies of twenty years ago at the Maryland station showed that it was important to let this clover grow

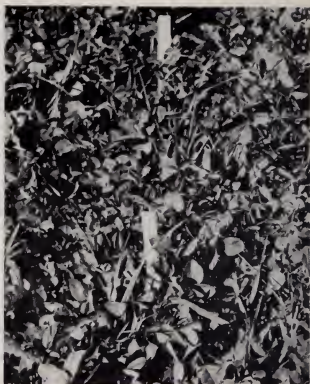
to a maximum size during the seedling year in order to build strong roots that could support a large hay crop the following year. Thus, the findings of this study tend to contradict earlier recommendations. Apparently these findings are due to changes in our agricultural management, such as:

1. More combined harvest with straw left on the land.
2. Strip cropping with less tendency to graze new seedings.
3. Use of more lime and fertilizer with increased growth of red clover and accompanying weeds.

All of these factors have tended to leave more plant growth on the land, causing an increase in insect and disease problems, and shading of the red clover.

Other important findings in the study were:

1. The major loss in plants occurs during July, August, and September of the seedling year, and immediately after harvest of the hay crop in the second year.



The effect of management on red clover stands. Left, poor stand resulted from straw left on the land after combining and no grazing or clipping during the seedling year. Right, good stand on the same field resulted from straw removed after combining, followed by a hay crop removed in late August of the seedling year. Pictures taken April 28, 1950 showing stand in the second or hay year.

2. Better stands and high yields were obtained from areas which received two or more clippings during the seedling year, and from which clipped growth was removed than from areas which received one clipping with growth removed.
3. The greatest average number of plants per square foot was maintained on plots that were mowed, and from which growth was removed in July, August, September, and early November. This practice was similar to rotation grazing.

Two-year averages for stand counts in the spring of the year ranged from a high of 10.3 plants per square foot to a low of 4.1 plants per square foot, while 2-year averages for yield of clover alone ranged from a high of 1,397 pounds per acre to a low of 583 pounds per acre of hay dry red clover. The higher yields and plant counts were on areas that received two or more clippings with growth removed. (Project B-56-c)

Tests Prove Kenland Red Clover Superior

Agronomists at the Maryland station are continually testing varieties of red clover so that Maryland farmers can obtain seed that will result in a high yielding hay crop. Adapted local seed that has been in Maryland for 10 or more years has always shown up well in these tests. If an adequate supply of this seed was available, Maryland farmers would have no problem in buying quality seed. Unfortunately, not more than 10 percent of the needs for red clover seed in Maryland are thus met. Another 30 percent of the seed needs are met by seed produced in Maryland that has not been here long enough to become well adapted. The remaining 60 percent of the seed has come from outside the state, much of which has not been adapted to our use. The following summary of yields of the three leading varieties in comparison to this commercial seed during

the years 1943 and 1948 at College Park shows clearly this comparison:

Variety	Average Annual Yield-Tons of Hay Per Acre
Kenland	2.3
Cumberland	2.0
Midland	1.8
Commercial	1.4

A summary of 12 tests at various locations in Maryland during the years 1947 to 1950 showed the following comparisons: Kenland, 2.9 tons per acre; Cumberland, 2.4 tons per acre; and adapted local seed, 2.8 tons per acre. With a new national program in operation to produce Kenland clover in large quantities, the results of these tests were widely circulated during the spring of 1951, and several thousand pounds of Kenland seed moved into Maryland for general farm use. It appears for the first time in our history that adequate quantities of a variety proved distinctly superior to commercial seed will be available for Maryland farmers to meet needs beyond those satisfied by locally adapted seed. (Project B-56-e)

Improvements in Orchard Grass Make For Wider Use

During the last 10 years orchard grass has advanced from a position of relative unimportance to the most widely used grass for semi-permanent pastures in Maryland. This change is a result of research findings of agronomists at the University of Maryland—results that have been brought to the attention of Maryland farmers. The commercial seed of orchard grass that is available has some weaknesses that need improving, principally the need for a variety that will mature later, and will thus be compatible with alfalfa. A variety that will be slightly less aggressive so that associated legumes will remain with orchard grass for a longer period is also desirable.

Maryland agronomists have been co-

operating with agronomists at the U. S. Department of Agriculture at Beltsville, and the Regional Pasture Research Laboratory at State College, Pennsylvania to develop varieties that are superior for use in this region. A large collection of orchard grass plants has been made and these have been divided into maturity groups. Outstanding plants have been selected from each group. Several years of testing and observation will be necessary before these can be combined into experimental varieties and their performance predicted for farmers of the state. (Project B-56-i)

Breeding For Further Improvement of Red Clover Underway

The Kenland variety of red clover is making an important contribution to better yields in the state. One of its main advantages is resistance to Southern Anthracnose, a disease that causes much loss in Maryland red clover fields. Cooperative work between agronomists and plant pathologists is now under way to select plants that are even more productive and that have resistance to other serious diseases. Progress has been made, but as with other grasses and legumes, it takes several years to develop superior varieties. (Project B-56-a)



Hand pollinating red clover to cross desirable plants to develop high forage quality. Cloth bags over blossoms are used to prevent insect pollination.

Soils

Studies Indicate That More Lime Is Needed

Soil scientists studied the effect of various liming materials on soil reaction as measured by pH. These current studies have been under way since 1946 at 10 locations in the state. In these studies the soil scientists developed a new method for determining adequate amounts of lime for various soil types.

The greatest change in soil reaction was found to occur from the second to the fourth month after lime was applied. Although only small differences in soil reaction were shown between five liming materials that were applied, the speed of reaction from most rapid to least rapid was as follows: Hydrated lime, burnt lime, finely ground limestone, semi-coarse limestone, coarse limestone.

From these studies and from earlier work, researchers have been able to develop a table showing the amounts of limestone necessary to raise various soils to pH 6.5, a level that is considered best for most field crops grown in Maryland other than tobacco and white potatoes.

Previous liming tables and data published by other experiment stations have shown considerably smaller amounts of lime needed to make this change in soil reaction. Farm experience in Maryland has indicated that past recommendations were too low to increase the pH to the desired level. This table is now in use at the State Soil Testing Laboratory, bringing the results of this research direct to the several thousand farmers who annually submit soil for analysis. (*Project O-47-a*)

Tons of Limestone Needed to Change Soil to pH 6.5

pH Unlimed Soils	Sandy Loam Soils	Silt Loam Soils	Silty-clay Loam Soils
4.8	2.50	4.00	6.00
5.0	2.25	3.60	5.40
5.5	1.50	2.40	3.60
6.0	0.75	1.20	1.80

Fertilizer Increases Yield of White Potatoes

Previous Irish potato fertilization studies in Garrett County have been primarily concerned with use of green manure crops and their effect on yields. The highest average yield per acre in previous work for the best treatment was 303 bushels.

The field plot work during 1950 was directed primarily toward supplying adequate amounts of nitrogen, phos-

phorus, and potash to obtain maximum potato yields. In a check plot on which 88 pounds of actual nitrogen only was applied at the time the plants were sprayed for disease control, the yield was 270 bushels per acre. Several treatments gave high yields; one of the most economical treatments in terms of results was the application of 256 pounds of nitrogen, 132 pounds of phosphoric acid, and 272 pounds of potash. This resulted in a yield of 512



The difference in top growth of these potatoes is due to fertilization. The potatoes to the left produced 270 bushels to the acre, while those on the right produced 512 bushels per acre.

bushels per acre. Additional harvest and fertilizer costs averaged 21 cents per bushel for the increased yield over the check.

This work is being conducted on an area which has a 3-year rotation of potatoes followed by oats, then followed by red clover hay. In addition to these high yields of potatoes, the yield of the oats that follows this heavy fertilization and the yield of the hay has been considerably higher than ad-

jacent areas that have received normal fertilization. (*Project O-28-b*)

Trace Element Needs of Alfalfa Determined

Various commercial trace element mixtures were applied to alfalfa seeded on a sassafras sandy loam soil to study minor element needs of this crop on this soil. The results are shown on the following table:

Alfalfa Yields as Influenced by Borax and Various Commercial Trace Element Mixtures Over a Two-Year Period (1948-49)

Trace Element Treatment	No. of Plots	Amount Applied (Fall—1947)	Amount Applied (Fall—1948)	Average Annual Alfalfa Yield (Tons P/A)
Borax	11	40	40	4.10
Es-Min-El	12	160	160	3.95
Es-So-Min	12	160	160	3.95
Mi-Min-Mix	12	160	160	3.92
Azome	12		160	3.84
Mineral Mix	12	160	160	3.83
Kaylorite	12	320	320	3.70
Check	24			3.80

All plots were treated annually with 640 pounds per acre of fertilizer having an average composition of 0-12-18.

(*Project O-49*)

Grain Crops

Field Corn Hybrids Being Widely Tested

Experiment Station agronomists studied field corn hybrids in six replicated field trials located in various areas of the state. There were 42 open pedigree hybrids in these tests. Hybrids U. S. 505 and U. S. 578 continued to demonstrate superior performance. Connecticut hybrids 870 and 845 gave much promise. On the basis of a four-state average, Maryland hybrid 990 ranked 4th in yield, showing much promise for future use. Detailed information concerning the finding of these tests have been published and distributed to Maryland farmers. (*Project B-50*)

Sweet Corn Hybrids Evaluated

Sixty hybrids were compared in a replicated test at College Park. Among these hybrids the following performed well: Illinois Country Gentleman hybrids 13 and 15, yellow hybrids Ill. 20 and 21, and Iowa hybrid Iochief.

In a uniform test of 21 experimental hybrids conducted cooperatively with New Jersey, Connecticut and Maine, New Jersey 101, New Jersey 103, Maryland 4 and Maryland 2 were outstanding. These results were reported in detail at the Maryland Cannery Conference, and were published and distributed in the state. (*Project B-44*)

Small Grain Varieties Receiving Careful Screening

WHEAT: To keep Maryland farmers abreast with the changes in varietal performance, and to evaluate new vari-

eties that are available, tests were conducted at the Plant Research Farm and at three other locations in the state. On the basis of averages for all four locations, the three high yielding varieties were Leapland, USDA 2381, and Nudel. In past seasons Leapland and Thorne have consistently ranked at or near the top. In the absence of severe leaf rust infection, USDA 2381 yielded on a level with the better varieties. This variety is being increased for farm use. Over a period of three years, Vigo, a Corn Belt variety that has appeared promising elsewhere, has ranked near the bottom. Apparently it is not adapted to this locality. (*Project B-39*)

BARLEY: Nine varieties of barley were tested in replicated plots at College Park. Lee winter oats were included in this test in order to compare barley and oat production. The highest yields were obtained from the Wong, Calhoun 3, and Jackson varieties. These results are similar to those in previous years. (*Project B-41*)

RYE: A summary of the work with rye during the last 9-year period shows that Southern varieties are more productive than Northern varieties. Kernel quality, as measured by plumpness, has not been consistently good for both the Southern and Northern varieties. In most of the trials where high yields have been obtained, there has been much lodging. With 400 pounds per acre of 3-12-6 fertilizer, yields have averaged from 20 to 25 bushels per acre. (*Project B-57*)

Tobacco

Plant Bed Methods Changing With New Findings

Farmers know the importance of an adequate supply of vigorous, healthy tobacco plants so that the crop will get a proper start. For years they have depended on clearing new areas for

tobacco seedbeds, preferably in a woods location, to avoid weed, insect, and disease problems. As progress has been made in improving plant beds, there has been a tendency for farmers to put these beds in a convenient location near a source of water for irriga-



Chemical control of weeds in tobacco beds. The area in the foreground was gassed with methyl bromide; in the right background, cyanamid was used; in the left background, urea was used but failed to control weed growth.

tion, and to use the same areas for that purpose each year. Research under way at the tobacco experimental farm has been designed to help these farmers get better plants.

Of particular interest during the past year has been the results of using methyl bromide as a seedbed fumigant. This gas has proved effective in controlling weeds, soil-borne insects, and nematodes. It has proved especially valuable for controlling grasses and horse nettle, a carrier of common tobacco mosaic. Previous tests with methyl bromide proved so promising that 20 cooperative tests with farmers were conducted during the past season. These tests indicate that the method will receive ready acceptance by farmers. From these research results an

Extension Fact Sheet was prepared giving a full discussion of the method, and describing the steps that should be taken in its use.



New research structures provided at Tobacco Research Farm. Left, curing barn donated by Tobacco Improvement Foundation for cooperative research. Right, new laboratory building including stripping room and machine shop.

Additional seedbed studies were concerned with the use of organic matter and variation in fertilizer to improve quality of plants. The use of organic matter more than doubled production of seedlings in soils of low organic content. (*Project B-59*)

Fertilizer Placement

With the tendency to increase the rate of fertilizer use on tobacco, studies have been under way to determine the best placement for heavy rates of fertilization. At a 1600 pounds per acre rate of 4-8-12, split applications were preferable with best results from 800

pounds placed in the row at the time of planting, followed by 800 pounds as a side dressing. Results to date indicate that substantial increases in yield were possible with increased fertilizer rates; however, the number of plants per acre should be increased as the fertilizer rate is increased if quality is to be maintained. It appears possible, with a combination of more plants per acre and increased fertilizer application, to get nearly double the yields that are generally obtained. Future studies are planned to determine the number of plants per acre that are desirable at various fertility levels. (*Project B-60*)

Weed Control

Cultivation Still Important in Field Corn Production

With the introduction of 2,4-D as a chemical method of controlling weeds, much interest has developed concerning all chemical herbicides. Ten weed control treatments were compared in replicated tests in corn fields at 10 locations during the past growing season.

The results from these tests show that the best control of broad-leaf weeds was obtained by any one of the following three practices:

1. Three normal cultivations.
2. Four hundred pounds of cyanamid pre-emergence, plus one cultivation at the time a second cultivation would normally be made.



(T11)—Corn plot which was treated with 1 pound 2,4-D acid equivalent 3 days after planting and cultivated once when plants were 18 inches tall. (T12)—Corn plot which had no chemical treatment but was cultivated twice, first when 4 inches and second when 18 inches tall. (T13)—Corn plot which received neither chemical treatment nor cultivation. Note the weed population and general yellowing of the corn.

3. Two applications of 2,4-D after corn plants had emerged, each at the rate of .5 pounds of acid equivalent 2,4-D, plus one cultivation at the time the third cultivation would normally be made.

Treatments involving cultivation, cyanamid, and 2,4-D were about equally effective in the control of grass, but none of these treatments gave yields significantly better than three normal cultivations. Regardless of chemical treatments, plots that were not cultivated made significantly lower yields than plots that were cultivated. Results for the past two years of study of chemical treatment for weed control indicates that some cultivation may be eliminated by these chemicals, but that cultivation still has an important place in field corn production. (*Project B-58-a*)

Chickweed in Fall-Seeded Alfalfa Can Be Controlled With Chemicals

Experimental work has shown that August seedings are more likely to result in good alfalfa stands than when the crop is seeded in small grain in the spring. Acreage is increasing and more alfalfa is being seeded in late summer or early fall. However, chickweed has

become a problem in August seeded alfalfa on many farms during the past few years.

Studies were begun in the fall of 1949 to study the effect of chemical control measures on chickweed in alfalfa fields. Findings to date indicate that one pound per acre acid equivalent of DNOSBP (4,6-dinitro-ortho-sec-butylphenol) sprayed on the chickweed in the fall when the alfalfa has become dormant, reduced chickweed growth to such an extent that alfalfa survived. In warm winters it may be necessary to use a similar application sometime before March 15 to check further the growth of chickweed before the alfalfa starts in the spring. These spray applications should be made when there is no surface moisture on the plants, when the temperature is above freezing, and when there are indications that 2 or 3 days of mild weather will follow. These applications should be made in 20 to 40 gallons of water per acre at 30 to 40 pounds pressure. Mimeographed material covering details of this spray, and methods of calibrating sprayers was prepared and released for general farm use. (*Project B-58-b*)

Seed Inspection

The Experiment Station conducts a regular inspection service of seed offered for sale in Maryland so farmers may know that the seed they buy has been properly labelled. More than 500 samples were collected from 100 retail seed dealers in 1950-51. In most cases, both agricultural and vegetable seed stocks were found to be tagged satisfactorily. Minor irregularities in labeling were called to the attention of deal-

ers for improvement or correction. (*Projects N-7, N-8*)

More than 3,500 samples of various types of seed were submitted to the laboratory during the calendar year 1950. Seeds were tested for purity, noxious weed content, germination, and such other factors that would indicate quality from the standpoint of seed use. (*Project N-9*)

Animal Husbandry

Research workers in the Experiment Station's Animal Husbandry Department are doing experimental work on problems in meat animal production. They also cooperate closely with workers in other departments on problems related to the production of forage crops, grain feeds and animal diseases. Field days are held annually to bring the latest information on the research

work with sheep, beef, and swine to farmers.

Some of the current work is pointed toward developing more precise methods of evaluating beef breeding stock more accurately, developing new breeds of swine to meet the increasing demand for meat type hogs, studying problems on bloat, pregnancy disease in sheep, quick curing of hams, and fertility studies with ram lambs.

Beef

Beef Research Pointed Toward New Methods of Evaluating Breeding Stock Earlier and More Accurately

For many years beef cattle producers have looked for some method of evaluating potential breeding stock more accurately, as well as earlier in the calf's life. Present methods require a prolonged feeding period. The result is that information on the rate and economy of gains is not available until the animal is over a year old. Therefore, the beef research being done in

Animal Husbandry is pointed primarily toward developing new methods of evaluating breeding stock accurately at earlier ages.

Forty-six beef calves have now completed individual feeding trials during the past two years to get data on the rate and economy of gain at early ages. Some of these calves were weaned at 90 days of age and some were weaned at 180 days. The results so far indicate that it is possible to evaluate calves

Type, efficiency of gains, and rapid growth are combined in this heifer weaned at 90 days. Her record: weights at birth, 90, 180 days and 1 year of age 62, 205, 338, and 736 pounds respectively. Rate of gain 180-370 days, 2.09 pounds per day. Total digestible nutrients per 100 pounds gain, 530 pounds. Another heifer of similar type gained only 1.12 pounds per day and took 810 pounds of T.D.N. per 100 pounds gain.





Differences in types, weights, and economy of gains of experimental calves being explained by Animal Husbandry researchers to cattlemen who have come to get the results firsthand.

earlier on their rate and economy of gain by weaning at 90 days than by waiting until the normal 180 days to wean. At one year of age there was no difference in these two groups of calves in either the rate or economy of gain. Twenty-six more calves are being put on trial to get additional data on this project. (*Project C-14a*)

Herd Classification Project Continued

Animal Husbandry researchers continue with a herd classification project, searching for the best method of recording and studying type and genetic transmission of body characteristics. Standards for herd evaluation such as those used in dairy cattle would be of much value in the beef industry. More critical methods of evaluation and permanent records of type are needed in the beef industry. Although more research is needed in this herd classification project, the methods already developed are practical and could be used by herd owners. Herd owners who are

now using this scoring technic are finding it of value when culling their herds. (*Project C-14b*)

Live Animal Measurements Show Promise for Estimating Weights of Wholesale Cuts

It is usually rather difficult to estimate accurately the value of a commercial beef animal. Visual inspection of animals may lead to some erroneous conclusions because body proportions affect the impressions one receives when observing animals. To help overcome this element of human error in judgment, animal husbandry research men working closely with the Maryland State Department of Markets have used various measurements on live beef animals to estimate the weights of wholesale cuts. The accuracy of their estimation is high; round, trimmed loin, and short loin, 87 percent; sirloin butt, 91 percent; rib, 94 percent; and cross cut, 97 percent. Slaughter weight and grade were very important in making these estimations. (*Project C-14c*)



A group of new Maryland No. 1 meat-type hogs.

Swine

New Line of Meat Type Hogs Developed

Farmers are hearing more and more about the meat type hog. Several economic and marketing conditions have brought this about. Therefore, research work with swine at the Maryland Station is being directed toward developing a new line of meat type hogs that will serve the farmers' needs and offer a new genetic base for market hogs. In addition, researchers want to get some fundamental information that will be useful to breeders in evaluating and selecting their breeding stock.

The new line of swine called the Maryland Number One has now been admitted to registry. It is $\frac{5}{8}$ Danish Landrace and $\frac{3}{8}$ Berkshire. To date, 100 pigs have been sold, for breeding purposes, to 12 different producers in

six different states. Most of these pigs have gone into the Corn Belt area of the midwest to be used as foundation stock for the production of crossbred and in-cross boars for sale to commercial producers. A small nucleus of the new line has now been established at the new swine barn on the Research Farm.

The results of data on this new line, as well as on other lines, indicate strongly that farmers should take the age of a gilt at the time she farrows into consideration when comparing performance records. The littler size from gilts seems to increase about one-half pigs per month through the farrowing ages of 11 to 18 months. Inbreeding of the dam has an adverse effect on the litter size, but inbreeding of the litter appears to have little effect. (Project C-8)

Sheep

Reasons for Sheep Pregnancy Disease Being Explored

It has been estimated that one ewe

out of every 50 or 60 in Maryland is lost annually from pregnancy disease.

The research staff in Animal Hus-



Pregnant Southdown ewes being fed a controlled ration to study pregnancy disease.

bandry, working with the Dairy scientists and the Livestock Sanitary Service is making a study of pregnancy disease in sheep to determine the cause of the disease, its possible relationship to ketosis as found in dairy cattle and the conditions under which it develops. Pregnancy disease, sometimes called ketosis, has been very troublesome during the late fall and winter months. Pregnant ewes, so affected, have a listless appearance, refuse to eat, segregate themselves from the rest of the flock and in most cases die during the last month of pregnancy. This condition seems to be associated with a deranged metabolism or an imbalance of hormones during the final stages of pregnancy, and in many cases affects ewes that are excessively fat. An autopsy usually reveals that the ewe was carrying two or more lambs.

During the last two years, unsuccessful attempts have been made to produce the disease experimentally in the Experiment Station flocks. Ewes were wintered on poor quality grass hay in an attempt to duplicate field conditions where pregnancy disease has been observed. Ewes were also fed to excessive fatness and then put on a par-

tial or complete fast during the later stages of pregnancy. Daily blood samples revealed a low blood sugar content but the ketone content could not be raised to a level found in true ketosis and no other symptoms of pregnancy disease appeared.

A number of pregnant ewes suffering from pregnancy disease in other flocks were brought to the Experiment Station for observation and treatment. Blood analysis showed a sugar and ketone content similar to that of the ewes that were fasted. Two such ewes were treated with cortisone in a manner similar to that used in dairy cattle studies where remarkable results have been obtained with this hormone in treating lactating dairy cows suffering from ketosis. No beneficial results were obtained with these sheep.

Further research is planned to study the physiological nature of pregnancy disease and its relationship to ketosis. Further attempts will be made to produce the disease experimentally and observations will be made in flocks in the State where pregnancy disease has occurred, to study the conditions under which it develops. (*Project C-15*)

Fertility Problems in Rams Under Study

Study of the development of reproductive organs and the portions of the germ cells that actually carry factors of inheritance has a great potential in answering some of the important problems of livestock raisers. Additional tissue has been collected to study further the time at which ram lambs first become fertile. The results so far indicate that ram lambs should be removed from the flock by the time they are 18 to 20 weeks old. A few differences have been observed between breeds in the earliness in which they produce good germ cells, but the differences are not great enough to warrant different recommendations.

Animal Husbandry scientists are starting to work on the problem of why some apparently healthy males are non-breeders. Plant work has indicated that in crops some sterility is caused by abnormalities of the small rod-like structures that carry the factors for inheritance. The study of these structures in farm animals is not far enough along to furnish definite results. (*Project C-16*).

Progress in Studying Methods of Injection for the Quick-Curing of Hams

Requests continue for exact information on how to cure hams safely and economically under farm conditions in order to guarantee a palatable, nutritious product. Estimates are that at least one out of every ten hams put in cure on the farm is lost due to spoilage by Maryland farmers.

To reduce these losses, research workers are studying methods of regional injection of hams so that recommendations can be made to farmers in order to produce a quality ham that will keep under farm conditions.

Salt content of the various muscles of the ham has been studied at varying

lengths of time after injection to determine how complete a penetration of salt is secured by regional injection.

When this work is finally completed it is hoped that the farmer can be provided with all the necessary information to successfully cure hams under farm conditions.

After being put through this standard cure the hams would be washed off, allowed to drain until dry and then given a regular hardwood smoke until a rich amber color had been produced. Hams so cured and stored under average farm conditions will remain sweet and wholesome during the current year and until a new season's cure is available. (*Project C-6*).

Bloat Research Being Stepped Up

In recent years Maryland farmers have been making rapid progress in developing and improving their permanent pastures. Many of these improved pastures contain Ladino clover varying from 25 to 95 percent of the total mixture. This clover is very popular, but considerable difficulty has arisen at times in its use because of bloat. The Animal Husbandry Department and Agronomy Department are conducting surveys of individual farms to determine more about the conditions under which bloat occurs. It is hoped that the results will help in developing practical methods of preventing bloat. Previously 53 farms in Maryland have been surveyed; of these farms 32 or 58 percent reported bloat. Ninety percent of these 32 farms were pasturing Ladino clover or Ladino clover mixtures. The total number of cattle on the 53 farms was 3,963 head, and the total number lost from bloat was approximately 2 percent.

Sufficient data have not been accumulated to determine the exact causes of bloat on pasture, but studies are being continued toward development of practical methods of control. (*Project C-18*)

Animal Pathology

The research work on animal diseases and parasites is carried on by the staff of the Live Stock Sanitary Service of the University of Maryland and is integrated with the Animal, Dairy, and Poultry Husbandry Departments. The work is conducted under carefully con-

trolled conditions in well-equipped laboratories.

The work in progress includes studies on anaplasmosis of cattle, infectious mastitis, blackhead of turkeys, Bang's disease, Newcastle disease, milk fever and ketosis.

Anaplasmosis of Cattle

A blood test has been developed by the Bureau of Animal Industry of the U. S. Department of Agriculture. When perfected, this test will aid greatly in controlling this disease in Maryland and in regulating against the importation of infected animals. Studies are being conducted at College Park which are intended to improve this test further and to make it more efficient. The results to date show a marked progress in improving the test fluid or antigen, which is the most important element of the procedure. (*Project D-50*)

Infectious Bovine Mastitis— Practicability of Several Control Measures Tested

All Maryland dairymen are acquainted with this disease and the losses suffered through reduced milk production and forced sale for slaughter of animals with damaged udders. The studies are carried out in selected herds throughout Maryland to determine and demonstrate the value of various sanitary practices in controlling mastitis, and to test the value of new drugs in treating it. Disposal of cows with unsound udders, separation of diseased and clean cows in the barn, and the use of the proper drugs have proved to be of practical value in many of the herds under study (*Project D-54*)

Revaccination for Bang's Disease (Brucellosis) Aids in Maintaining Resistance

The vaccination of calves with *Bru-*

cella abortus Strain 19 vaccine has proved of great value to the livestock industry in controlling and eradicating Bang's disease. The use of the vaccine in mature cows in infected herds has also been valuable in preventing severe economic losses. It has served as an emergency measure until calfhood vaccinated replacements have become available. The revaccination of previously vaccinated animals using small doses of vaccine has given some promise as a means of maintaining resistance in heavily infected herds. (*Project D-46*)

Experiments with Blackhead (Infectious Enterohepatitis)

The efficiency of various chemicals and drugs against blackhead of turkeys is being tested by methods developed in the Department of Animal Pathology. One of the newer drugs available and currently being sold under the trade name "Enheptin" has proved valuable under laboratory and field conditions. As a prophylactic, the drug is being incorporated in mash in the proportion of 0.05 per cent. In several experiments poult treated with this drug developed the disease at the rate of 3.4 per cent when exposed, whereas 63.9 per cent of untreated controls became diseased. It is not clear from the trials to date whether or not such treated and exposed poult retain resistance after the drug is withdrawn. Extended studies concerning other organisms associated with the blackhead parasite are in progress and

tend to show that the parasite is the primary tissue invader, being joined later in the course of the disease by other organisms. It would thus appear that improved treatments should be directed primarily against the black-head parasite rather than against associated organisms. (*Project, D-51*)

Rumen Fermentation and Its Resulting Distinctive Relation to Ketosis in Cattle

Milk fever and ketosis (acetonemia) continue to cause losses to Maryland dairymen by decreasing milk production and through the death of cows. Studies have been made on volatile acid formation in the rumen with a determination of the percentages of the acids. On the basis of results, glycerin and tripropionin have been tried in treatment. Results have been encouraging. The use of chlorethamine before and after the development of milk

fever has been partially successful. (*Project D-53*)

Newcastle Disease Investigations Continue with Particular Reference to Vaccine Modifications and Virus Relationships

The losses from Newcastle disease result from decreased egg production, decreased weight gain, deaths, and cost of immunization and other control measures. Further efforts have been made to improve the vaccine produced through modification of the virus by growing it in hamsters. The virus has been adapted to cave bats, brown bats, and shrews. Experiments have been continued to determine the possible relationship of Newcastle and poliomyelitis viruses. In trials with monkeys it was shown that strains of Newcastle virus vary in ability to produce resistance in monkeys to challenge with poliomyelitis virus. (*Project D-52*)

Botany

Research workers in the Botany Department represent several branches of applied botany. For example there are plant physiologists, plant pathologists, plant breeders, cytogeneticists and taxonomists. The research they do may be either of the type with immediate practical application or of the more basic type which seeks to anticipate future needs. In either case the ultimate objective of the research is to promote better living by contributing to increased efficiency of agriculture.

More specifically the physiologists are studying methods of retaining the quality of stored vegetables and are developing leaf tests to help farmers

know when and how much fertilizer to apply.

Plant pathologists are doing research on the prevention of the heavy losses Maryland farmers suffer annually from the inroads of diseases of farm crops, fruits, vegetables and ornamentals. They are developing resistant varieties of many crops, improved spray programs and chemical treatments for seed and soils. One phase of the work seeks to find the basis of how fungicides control plant pathogens.

The plant breeders direct their work toward improvement of crop plants and development of new varieties by practical application of the basic laws of heredity.

Plant Diseases

Resistant Varieties and Fungicides Help to Control Late Blight of Potatoes

Plant pathologists have been giving

Maryland potato producers considerable help in reducing losses caused by late blight. First, in cooperation with the USDA, several resistant varieties,

including Kennebec, Sebago, and Ontario, have been studied. Ontario, Cherokee, and Yampa (the two latter are early varieties) are resistant to both blight and scab. It is possible that eventually they may replace Irish Cobbler in scabby soil.

Plant pathologists have been working on several spraying experiments designed to determine the relative merits of Bordeaux mixture when used alone and when used in combination with DDT. Results of three to six years work show that all varieties tested yielded more when Bordeaux was mixed with DDT, but the gains were larger with varieties that were most susceptible to late blight. Even with the more resistant varieties, diseases were more thoroughly controlled when a Bordeaux mixture with DDT spray was used especially during seasons favorable to late blight. (Project J-80-A)

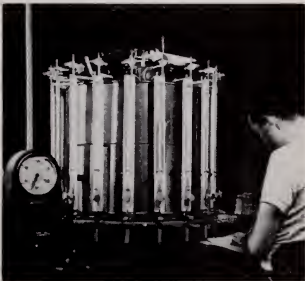
Spray Research Has Helped to Increase Tomato Yields

The average per acre yield of tomatoes has been on the increase in Maryland in recent years. In part this may be attributed to better disease control through the more general use of fungicidal sprays. Plant pathologists have developed a spray program that controls the major fruit and foliage diseases, including the destructive late blight. Even when late blight was not present, this spray program increased yield by 25% in one field test and resulted in over 30% increase in peeled, trimmed tomatoes ready for canning. Field testing has also helped in developing spray programs for melons and peppers, and in developing seed treatments for controlling diseases of various vegetables. (Project J-87)

How Fungicides Work Now Being Explored

Fundamental research now under way reveals that one of the newer organic sulfur fungicides controls fungi by eliminating a portion of their res-

piration that is necessary for growth. Enzymes break down the fungicide and release materials toxic to the fungus. This type of research will prove very valuable in developing more effective use of fungicides and developing better fungicidal materials. It will also contribute to a better understanding of basic processes in many kinds of living cells. (Project J-87)



Research worker in Plant Pathology using a microrespirometer to study the basic effect of a fungicide material on respiration of a pathogenic fungus.

New Strawberries Developed That Resist Both Strains of Red Stele

Some years ago the red stele disease of strawberries appeared in Maryland. The fungus that causes this disease persists in the soil making it impossible to raise standard varieties of strawberries. USDA and Maryland plant pathologists promptly started a cooperative project to breed and select resistant varieties. They have developed Temple, a red stele resistant variety, that is now the leading variety in the Pittsville-Willards area. About 1,000 acres of Temple are grown in Maryland and the acreage in other parts of the country is steadily increasing. Much of the Maryland acreage is in red stele infested soil where standard varieties cannot be grown. In addition to its resistance to red stele, it also produces high yields of excellent quality fruit.



These strawberries resulting from the breeding program have the same parents, but #2131 is resistant to red stele, while #2130 is very susceptible.

Recently another strain of the fungus that causes red stele has been discovered. Temple is resistant to only one of them, so pathologists are now devel-

oping varieties that resist both strains. Two selections now in the test plots are the first strawberries known to have this type of dual resistance. Thus it has been proved that resistance to both strains can be combined in one variety. Of 30,000 seedlings tested in the greenhouse last year, 5,000 were planted in the field for further test. Of the 5,000 tested in the field last year 140 were retained for further testing of yield and quality. (*Project J-78-A*)

Better Disease Control in Sweet Potatoes Being Achieved

There has been a concerted effort in recent years by plant pathologists and horticulturists to improve the quality and yield of sweet potatoes in Maryland.

Work on this project has contributed to development of fungicidal dips for seed and sprouts which are now used widely. They give good control of the scurf disease, improve the stand of plants in fields infested with *Fusarium* wilt, and help control black rot.

It was found that an acid-tolerant strain of the fungus that causes pox disease exists in Maryland soil. This



Method of testing for antagonism of various organisms to the fungus causing black rot of sweet potato. Fundamental work such as this forms the basis for many successful control measures.



Typical pox disease and cracking were produced in sweet potatoes artificially inoculated with streptomyces ipomea. Left, pox symptoms. Center, cracking. Right, uninoculated roots grown under same conditions.

offers an explanation of why sulfur treatment of the soil has failed to control pox here while it has worked well in some other states. An association has been found between pox and sweet potato cracking.

A 3-year field test of comparative susceptibility of six sweet potato varieties to several common diseases was completed. Results serve as a basis for recommending the best variety to plant where a particular disease limits production.

The possibility of controlling the black rot disease by using fungi or bacteria that produce antibiotic substances like penicillin is being investigated. (Project J-86-A)

Strains of Tobacco Being Developed That Will Resist Several Diseases, Especially Black Shank

Maryland tobacco growers lose thousands of dollars each year because of diseases. This project is designed to develop improved strains of Maryland tobacco that resist the major diseases: black shank, mosaic, Fusarium wilt, black root rot, wildfire, anthracnose and blue mold. All of these seriously

affect the quantity and quality of tobacco being produced in Southern Maryland.

At present the Robinson strain of Maryland tobacco is highly resistant to Fusarium wilt, while the Catterton strain has a fair degree of resistance to black root rot. Both of these strains are commonly used by Maryland growers.

During the past few years U. S. Department of Agriculture tobacco research workers have crossed Maryland broadleaf with resistant wild strains and species of tobacco and have produced strains resistant to mosaic, black root rot, wildfire and black shank. In some cases resistance to the first three diseases has been combined in the same plant. Work has also been started on development of strains that are resistant to anthracnose. Present work in cooperation with agronomists at the Maryland tobacco experimental farm involves selection of mosaic resistant lines which possess characteristics of the Maryland broadleaf variety.

Black shank was first found in Maryland in 1949 and was found again in 1950. Because of the seriousness of

this disease, work toward the development of a resistant strain was begun in 1950 and is being pushed forward as rapidly as possible. The U. S. D. A. and the Department of Agronomy at the University are cooperating in this work.

In 1950 U. S. D. A. tobacco research workers made crosses of Maryland broadleaf with Florida 301 (resistant to black shank) at Oxford, N. C. These crosses were tested for black shank resistance in infested soil. Seed was collected from plants that survived the tests and was brought to Maryland where plant pathologists will make further tests for resistance in 1951.

Because of the danger of spreading black shank, the field experiments are conducted on a 1-acre plot of land well isolated from other tobacco growing areas. The plot has been completely fenced to prevent live stock and unauthorized persons from accidentally carrying infested soil to new areas. As an added precaution a shed has been built inside the enclosure to house all machinery used on the plot so that it need not be removed from the area until it has been properly disinfested at the completion of the project. (*Project J-89*)

Identification and Control Procedures for Plant Virus Diseases Being Developed

Work is now under way on a broad

project designed to develop methods of identifying and controlling plant virus diseases. The Botany, Agronomy, and Horticulture Departments of the University and the U. S. Department of Agriculture are cooperating in this project.

The scope of the research, comprising both basic and applied phases, is illustrated by the work under way which includes: (1) an indexing method for identification of the leaf roll virus in potato tubers; (2) a suitable host for indexing various strawberry viruses; (3) a field survey of the range and severity of stone fruit viruses (new areas of infection by peach yellows and little peach have been discovered); (4) location of areas suitable for production of virus-free nursery stock and bud stock of stone fruits; (5) weed hosts as reservoirs of tobacco mosaic virus near plant beds and fields; (6) heat inactivation of mosaic virus in tobacco refuse to permit its use in fertilizer (in cooperation with Northern Regional Research Laboratory); and (7) investigation of the host range, vectors and cytological and physiological effects of the "leaf curl" virus of tobacco which is apparently a new disease to this country having been found, so far, only in Maryland. (*Project J-88*)

Plant Breeding

Boron Found to be Important in Flowering and Fruiting of Plants

Scientists have observed that boron plays a very important part in the flowering and fruiting of plants. For example, the effect of boron has been popularized widely in connection with seed production of alfalfa. Special fertilizers containing borax have been compounded for use on alfalfa and have resulted in phenomenal increases in seed production.

To determine more specifically the role of boron in flowering and fruiting, Maryland plant physiologists are experimenting with various species of lilies in which large floral parts are available for study and analysis. There is a possibility that the inability of certain species to cross may be due to boron content alone. Botanists now believe that it may be possible to manipulate the boron content of species in such a way that crosses may be made

which hitherto have been impossible. Plant breeding programs throughout the country may be expected to undergo important changes should further work confirm present indications. (*Project K-8-A*)

Pepper Breeding Being Advanced by Using the Twin Seedling Haploid Technique

Commercial varieties of pepper are quite variable as a result of hereditary changes that have accumulated over a number of years. As in other plants, a typical pepper seed produces a single seedling that derives one-half of its hereditary constitution from each of its parents. Since hereditary differences occur in the parents, variation among plants grown from seed is quite evident.

Many twin and triplet seedlings have

been found by sprouting approximately 250,000 garden pepper seeds in the research laboratory.

Research on the twin seedlings has shown that one member may originate from the female parent and have only one-half as many hereditary units as an ordinary plant. These plants are called haploids. By means of chemical treatment, it has been possible to double the single set of hereditary units to produce plants in which both sets of hereditary units are identical. Such plants, called doubled haploids, produce progeny free from hereditary variability. Thirty doubled haploid peppers have been produced, several of which show promise as commercial varieties. Recently multiple seedlings have also been observed in corn and regal lily. (*Project F-15-A*)



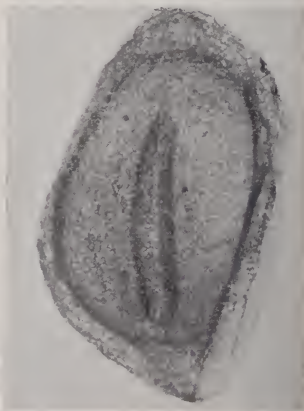
Top, center—a twin pepper seedling. Left—plant that developed from the larger twin. It has characteristics of both parents. Right—plant that grew from the smaller twin. It is a haploid with characters of the mother plant only.

Development of New Varieties of Crop Plants Hastened by Basic Studies of Heredity

Plant breeders throughout the world have crossed different species of lilies to produce new hybrids of considerable horticultural value. Progress is retarded because crosses between different species often fail to set seed. Maryland cytogeneticists are studying hybridization of native lily species in an attempt to determine some of the hereditary relationships in this group of plants which may limit their ability to set seed.

The same scientists are seeking to improve asparagus by increasing its chromosome number. Chromosomes carry the hereditary units, and each plant has one set of chromosomes from each of its parents. It has been observed previously that by use of the chemical, colchicine, an increase in chromosome number sometimes can be obtained. This is of importance since it often results in plants of larger size. A number of seedlings of the leading commercial variety of asparagus, Mary Washington, were treated with colchicine. Microscopic studies showed that the chromosome number was doubled in eleven of the treated seedlings. These seedlings will be grown to ma-

turity and their quality compared with that of standard varieties.



Lilies have large floral organs and make excellent "plant guinea pigs" for research upon basic factors controlling flowering, fruiting and set of seed.

Lily seeds photographed by transmitted light, much enlarged. Above: normal seed with a single embryo. Below: seed with twin embryos, one or both of which may give rise to a pure breeding line.

Naturally occurring variation in the chromosome number in the cells of the tomato variety, Pan-America has also been studied. Ordinarily the chromosome number is quite stable; however, root tip cells with 25 and 26 chromo-

somes have been observed in addition to cells with the typical number of 24. Research to date has not revealed the significance of this variation. (*Project F-9*)

Plant Physiology

Additional Studies on Methods of Breaking Rest Period of Spring-grown Potatoes for Use as Fall Planting Stock

Research in 1950 confirmed and extended previous conclusions that of all the chemicals and combinations that have been used over a period of several years, Ammonium thiocyanate is most effective in hastening sprouting of spring grown seed for planting the fall crop. No effective treatments have been found to prevent seed piece decay when the soil is hot and dry. Even in cool moist soil effectiveness of the rest breaking treatment varies with variety. Irish Cobbler responds very poorly while Progress and Marygold respond well. Widespread use of the technique apparently will depend upon the adoption of new varieties of potatoes. (*Project J-85*)

Searching for Better Methods of Storing Vegetables

The search continues for better ways of storing vegetables to maintain the quality that existed at the time of harvest. Of great interest in recent storage studies is the use of one or more of the "plant hormones," such as maleic hydrazide to slow down the rate of respiration and hence loss of sugar. Researchers in plant physiology are currently studying maleic hydrazide, either for use alone or in conjunction with refrigeration. (*Project K-7*)

Leaf Tests Being Developed to Help Farmers Know When and How Much Fertilizer to Add

Plant physiologists believe that it

should be possible to determine accurately the relationship between the mineral composition of leaves of crop plants and the yield the crop will produce. Once this is done scientists would know for each crop how much nitrogen, phosphorus, potash, calcium, etc., should be in the leaves to produce top yields. They would also know when addition of more nutrients would not result in increased yield. Without such basic information, it is sometimes impossible to interpret analyses after they are made. It is obviously important to the farmer to know what element is needed by plants and when its addition would bring a profitable return. He could save money by not adding fertilizer that is not needed. "Sufficiency" values have been determined for a few crops, but for most crops information of this type is lacking.

Currently researchers are collecting data on snap beans, tomatoes, field corn, tobacco, and Irish potatoes. Although at present, very accurate and time-consuming chemical methods must be used in the laboratory, ultimately it is planned to develop simple, field "quick tests" for leaf tissue that will replace the laboratory analyses. (*Project K-8-B*)

The Occurrence, Distribution, and Economic Importance of the Native Plants of Maryland Continues to Receive Study

Citizens of Maryland, like those of other states, continue to show deep interest in the wild plants that abound

around them. They need to know which are poisonous to man and livestock, which are likely to become noxious weeds and which have value as ornamentals in home plantings.

Research in taxonomy supplies such information and helps to build up and improve the collection of Maryland

plants preserved in the Herbarium. A collection of Maryland mosses was added this year.

Work was started on a brief manual of Maryland plants that will be useful not only to students, but to everyone interested in the wild plants of our state. (*Project F-12*)

Dairy

Since the dairy industry in Maryland is one of the largest agricultural industries in the state, considerable research work is being done at the Experiment Station. The work is divided into two phases: dairy production and dairy technology.

The dairy production phase is concerned with such things as measuring the nutritive value of various feed-stuffs, studying in minute detail the various processes of milk formation in the cow's udder, and in finding the

answers to such elusive questions as what causes and what is the treatment for ketosis in dairy cows.

Dairy technologists are working on problems associated with processing milk into nutritious foods for human consumption. Ice cream and cheese are examples of foods developed from milk on which dairy researchers are working. They are also working on studies to measure the fat variations in milk being sold by dairymen to dairy processing plants.

Dairy Production

Cause of and Treatment for Ketosis (acetonemia) Discovered

Ketosis or acetonemia is a condition that occurs in cows usually within a few days to a few weeks following calving. It has caused large financial losses to the dairymen of Maryland as well as in other states due to the decreased milk production, the cost of treatment, and in some cases, the loss of the animals. The most common symptoms observed by dairymen are poor appetite, decreased milk production and rapid loss in body weight, either lethargy or high excitability, and in many cases a general stiffness and lack of coordination. It has been recognized for many years, but the cause was unknown until this year.

Dairy research workers, after studying this problem for several years at

the Maryland Station, have found the fundamental cause of ketosis. They have also developed a very rapid and effective treatment. The work was carried on in conjunction with practicing veterinarians in Maryland.

During the past 2 years biochemical and histopathological studies of the endocrine glands of cows with ketosis have been made by research workers of the Dairy Department. These studies show that the fundamental cause of ketosis is associated with improper functioning of the adrenal and pituitary glands. The cause of the failure of these glands to function in the normal manner remains to be determined.

Two materials were found to be effective in producing a rapid recovery. They are cortisone, a synthetic hormone, and corticotropin (ACTH), an

extract of the pituitary gland. The response to either of these materials was miraculous and both are far superior to the old method of injecting dextrose.

Cows that did not recover following the use of dextrose have been cured within a few days by the use of cortisone. Usually one treatment was sufficient, but in a few cases two or three treatments were necessary. The blood sugar level, which is always low when a cow has ketosis, returned to normal within 4 to 8 hours following the use of cortisone. The appetite and general appearance of the cows usually showed a marked improvement within 24 hours. The blood ketones, which are high in ketosis, decreased to normal within 3 to 4 days, and the milk production exhibited a marked increase in most cases by the third or fourth day. Detailed studies have been made this year with over 30 cows treated with cortisone and two cows treated with ACTH. Recovery occurred in all cases.

The combination of dextrose and cortisone was even more effective than cortisone alone. Cows that had ketosis complicated by an infection such as metritis recovered more quickly when the infection was treated at the same time that cortisone was administered. (*Project G-37*)

Measuring the Nutritive Value of Alfalfa Hay

As the trend toward grassland farming has continued at a steady pace, dairy research workers initiated a study to determine the various nutritive values present or absent in our common roughages. A group of cows that were fed alfalfa hay alone did not consume enough hay to meet their total energy requirements. But produced as much milk as was expected on the basis of the energy content of the alfalfa hay they consumed. The alfalfa hay used in these studies was not deficient in any of the known nutrients needed for milk production. These re-

sults do not agree with those reported earlier by other Experiment Stations.

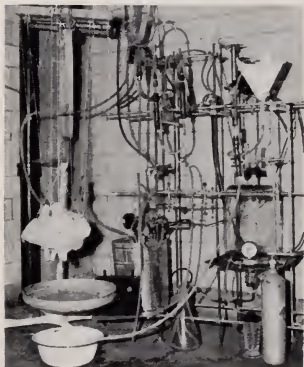
It was possible to measure the feeding value of alfalfa hay very closely from the approximate chemical analysis when the net energy system was used. The total digestible nutrient system of measuring the feeding value of hay for milk production overvalues most hays by 10 to 20 percent. U. S. No. 1 green leafy alfalfa hay was made field cured. Both lots were cut at the same time, but the part that was field cured was rained on during the curing process. This lot of hay was higher in fiber due to the loss of leaves and the feeding value was considerably lower. The feeding value of the field-cured hay that was rained on approximated the net energy value calculated from the approximate chemical analysis. The milk production on the barn-cured hay was almost twice that obtained from the other lot of hay from the same cutting that was field cured and rained on. (*Project G-39*)

Milk Secretion

Some strange phenomena in the formation of milk in the udder are not clearly understood. Therefore, a special apparatus known as the heart-lung perfusion apparatus has been used to study the chemistry of the formation of various milk substances. This is accomplished by removing the udder from the cow immediately after slaughter and connecting the blood vessels to a system consisting of an artificial heart to pump blood through the circulatory system of the udder. An artificial lung is included in order that oxygen can be added to the blood to replace that removed by the udder. Analysis of the blood before pumping it through the udder and after it has passed through the udder makes it possible to determine what blood substances are used by the udder in the formation of milk since no other organs are involved in a study of this kind.



Identical twins are being used by the Dairy Department in various feeding experiments. The information obtained from an experiment with one set of identical twins is estimated to be equal to that obtained with 20 pairs of animals which are not related.



An artificial heart-lung apparatus developed by the Dairy Department is being used to determine how milk is made. This apparatus pumps blood through the udders of cows. Radioactive substances are added to the blood to determine which blood substances are used in the formation of milk. A cow's udder obtained from a local abbatoir has been hooked up and the "artificial cow" is about to go to work.

It has been found that acetic acid is produced in large quantities in the rumen of the cow as a product of the metabolism of food and this material is also used in large quantities by the udder for the formation of milk.

A problem encountered in udder perfusion studies has been vascular constriction. This condition results in a reduced flow of blood through the udder and was found to be due to adding too much oxygen to the blood. The difficulty can be prevented by maintaining the oxygen content of the blood at a normal level during the perfusion studies.

During the course of these studies evidence of the presence of a new enzyme in the udder has been found. Indications are that this enzyme should yield important information as to how milk fat is formed.

Some experimental work has been carried on using surface-active agents to determine what effect these might have on the formation of milk fat. One of these was injected intravenously into the cows and increased the blood fat as much as ten times the normal level. However, change in milk fat production was observed in the lactating cows receiving these injections, thus indicating that the level of fat in the blood is not the primary factor in the formation of milk fat. (Project G-43)

Fat Requirements in the Dairy Ration

Over a period of years a problem of interest to dairymen and feed manufacturers has been the question of the amount of fat needed in the grain mixture. For many years 4 percent fat was considered as the minimum level in the grain mixture. During the past 10 years more of the fat has been extracted from the grain feeds for use in other industries. Work that has been done at other stations shows that less than 4 percent fat can be used without material loss in milk production.

Since it is likely that less fat will be available in the grain feeds, a study was initiated using a new approach to the problem. Twelve cows were fed rations of low fat content and the amount of fat was gradually increased over a period of several weeks to find

out if there is an optimum level of fat intake. The energy intake of the cows was controlled at the same time. The work to date indicates that there may be an optimum fat intake. Further work is planned along these lines. (Project G-38)

Dairy Technology

Butterfat Test Variations in Milk Sold By Producers

The variation that occurs in butterfat tests on milk sold by dairymen is a problem of concern to them. This study presents information relative to the variation in the fat content of producer milk as received daily in the dairy plants.

Milk delivered by 96 producers was tested daily for 31 consecutive days. The average difference between the lowest and the highest test during the 31-day period ranged from 0.50 percent for the smallest producers delivering less than 175 pounds of milk daily to 0.24 percent for the largest producers delivering more than 800 pounds of milk daily. The results are presented in the following table:

There was no difference between 10-day composite tests taken in amounts proportional to the weight of milk delivered in comparison with samples of uniform size regardless of the fluctuation in daily weights of the deliveries.

A study of the general characteristics, capacity and construction of number of weight cans revealed that, in most instances, sufficient agitation for accurate sampling was accomplished in the can dumping procedure. In cases where this was not true it was found that hand or mechanical agitation can readily be provided to insure accurate sampling. There was no difference in fat test between samples obtained with automatic samplers of the vacuum type, as compared with samples taken by hand dippers. (Project G-35)

Variations in Butterfat Tests in Relation to Size of Deliveries

Size of Daily Deliveries	Average Difference Between Lowest and Highest Test Within Sampling Period, Percent Butterfat.			
	Period I March 16-25	Period II March 26-April 5	Period III April 6-15	Average for 31 days
Less than 175 lbs.....	0.42	0.54	0.59	0.50
175 to 450 lbs.....	0.43	0.47	0.41	0.44
450 to 800 lbs.....	0.37	0.39	0.32	0.36
Over 800 lbs.....		0.24	0.25	0.24
Average variation for 96 producers				0.41

Stabilized Berries for Strawberry Ice Cream

A superior quality product can be expected when ice cream is made with commercially stabilized strawberries.

In general strawberries stabilized in the ice cream plant will improve the finished ice cream, but not to the same degree achieved when the berries are stabilized by the fruit packer. The use

of fruit stabilized in the ice cream plant resulted in a finished ice cream that exhibited a tendency to be over-stabilized and possessed poor melting qualities.

The flavor intensity can be improved by using both plant stabilized and commercially stabilized fruit, since the berries do not become icy and the ice cream surrounding the fruit particles does not develop any marked degree of coarseness. (*Project G-42*)

Chemical Changes in Milk Fat as Related to Flavor in Dairy Products

The quality of practically all dairy products is affected by chemical changes in the milk fat either during processing or storage. In some cases these changes are desirable, especially in fermented dairy products, such as cheese. In other products such as market milk, powdered milk, butter and ice cream, any chemical change in the milk fat is undesirable. The object of one phase of the present research in the Dairy Department is to study the fundamental chemistry of these various changes in order that the practical

problems of the dairy industry can be better understood and remedied.

Milk contains an enzyme, or group of enzymes, that are capable of hydrolyzing milk fat to liberate free fatty acids. These free acids are present in most varieties of cheese and contribute to the desirable flavor of the cheese. When these free acids are present in milk, butter and ice cream, they impart an objectionable flavor to the products.

In order to understand better the enzymatic hydrolysis, it seems advisable to determine quantitatively the individual liberated acids. The same method for separating acids is being applied to other dairy products to clarify the mechanism of milk fat hydrolysis by enzymes.

Another type of chemical change occurring in milk fat is oxidation, which is invariably undesirable in dairy products. Methods for the isolating and identifying the degradation compounds formed in oxidized fat have been studied. Particular attention has been given to a study of the Kreis Test, a chemical colorimetric test for oxidized fat. Various colored compounds have been separated from the Kreis reaction on oxidized milk fat and their properties are being studied to help explain the mechanism of fat oxidation. (*Project G-34*)

Flavor Compounds in Cheddar Cheese

The largest selling variety of cheese is cheddar. In recent years, due to the use of pasteurized milk instead of raw milk for the manufacture of this type of cheese, certain problems have arisen. A consistent quality can be obtained in pasteurized milk cheese; however, the quality seldom approaches that of a good raw milk cheddar cheese. This has stimulated renewed interest in the ripening mechanism of cheddar cheese. A study is being made of the compounds responsible for the flavor. Acetaldehyde, a compound not previously reported in cheddar cheese, has



Chromatographic column for separating fatty acids.



Continuous extractor for isolating flavor compounds from cheese.

been identified. Qualitative evidence of the presence of several other new carbonyl compounds in cheddar has been obtained and dairy researchers are pursuing their efforts to identify these compounds. (*Project G-35*)

High-Temperature Heat Treatment of Dairy Products

The processing of dairy products with high temperature heat treatment is widely practiced. While this has certain advantages, there are certain difficulties associated with high temperature. The brown discoloration and cooked flavor are the two most serious difficulties. Dairy researchers are making a study of the browning of heated milk with the object to help explain the fundamental mechanism of color development. The identification of compounds formed in heated milk is also being pursued.

High-temperature, short-time pasteurization studies of ice cream mix were made to determine the effect of high temperature, short-time pasteurization on the various properties of the ice cream mix and the finished product

when different ice cream stabilizers were used. The findings indicated that the stabilizers used under these conditions will give results similar to those obtained under normal mix pasteurizing conditions. There are noticeable but not marked effects of temperature of pasteurization on the properties of the mix and the finished ice cream.

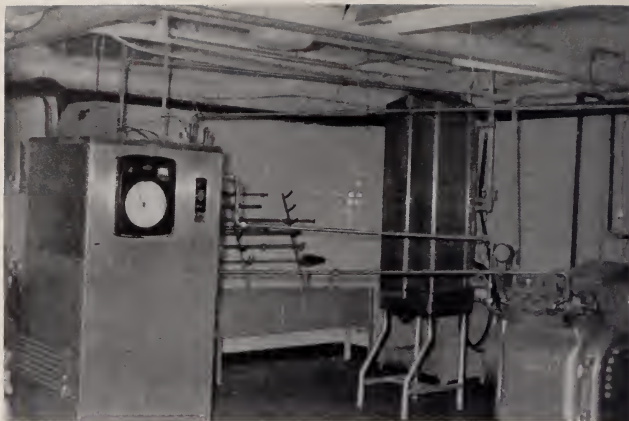
It appears that the higher temperatures of pasteurization will give a more desirable product with the optimum condition being, in most cases, 190° Fahrenheit. In a number of cases, an unnatural flavor was noticed in the finished ice cream after 6 weeks of storage at 6° Fahrenheit, when the mixes were pasteurized at 170° Fahrenheit. In some cases this flavor was also found in the mixes pasteurized at 180° Fahrenheit.

When gelatin, cellulose gum (carboxymethyl cellulose) guar bean gum, locust bean gum, superheated milk, and propylene glycol alginate were used the results obtained indicate that cellulose gum and locust bean gum combination and propylene glycol alginate give the most favorable results as ice cream stabilizers. (*Project G-40*)

Buffer Salts as Acid Standardizer for Ice Cream

A study was made to evaluate the relative effects of developed and adjusted acidity in the manufacture of ice cream. The relative effects of common acid standardizers of the buffered, double and single salt types, on the various properties of ice cream mix and finished ice cream were compared.

The results obtained indicate that the use of buffered salts to reduce mix acidity had the most favorable effect upon the properties of the finished product. The excessive use of a double salt composed principally of divalent ions, had a pronounced influence upon the physical properties of the ice cream mix. However, the presence of these



Experimental equipment used in studying high temperature, short time pasteurization of ice cream mix.

ions in a moderate amount tended to produce a desirable effect on the body and texture characteristics of the finished product. The use of a single salt acid standardizer produced an undesirable product unless used in moderate amounts.

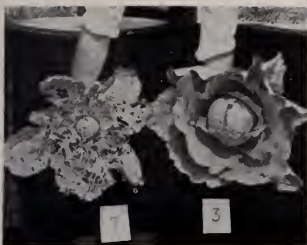
In general, the moderate use of acid

standardizers to adjust mix acidity tends to improve the character of finished ice cream. Preliminary trials indicated that when high-temperature, short-time pasteurization was used, acid standardization could be practiced only to a limited degree. (*Project G-42*)

Entomology

Entomologists and farmers alike have long recognized that the battle between crops, both plant and animal, and insects is a tough and costly one. Research is being done at the Maryland Experiment Station to discover every possible means of controlling these destructive insects. Trained entomologists are studying insects that attack field crops, horticultural crops, ornamental crops, and livestock. Chemical sprays, insect parasites, and improved cultural practices are among control methods.

Some of the most dangerous crop insects are the Japanese beetle, the European corn borer, the Mexican bean beetle, the armyworm, and several insects that attack tobacco plants and orchard crops. Some work is being done with ornamental crop insects. Other entomologists are developing various methods that will control or eliminate insects that affect livestock and people. One bee project is also under way.



Newly developed insecticides give superior control of the cabbage worm.

Progress Being Made on Controlling the Pea Aphid

Ever since canning peas were first produced in Maryland the pea aphid has been its most costly enemy. The damage is usually the most severe in seasons of light rainfall.

Through the years several insecticides have been studied for control of this insect. With the advent of DDT more effective and consistent control was obtained than from any previous insecticide. Its biggest disadvantage was that it left a residue on pea vines that might be used to feed livestock. More recently parathion has been tested. It is an excellent pea aphicide that leaves no residue on the vines,

but it is extremely poisonous to higher animals and hazardous to apply.

Entomologists are now searching for an aphicide that is effective, and yet not dangerous to livestock or humans. (*Project H-29-6F*)

Mexican Bean Beetle Still Hard To Control

Experimental work on the control of this insect has been carried on almost continuously since its first appearance in 1926. Before World War II dusts of ground derris root gave highly satisfactory commercial control of this insect, but the supply of derris root was cut off during the war and has not yet been fully resumed. Rotenone insecticides from other sources are not equal to the derris product. This resulted in considerably poorer commercial control.

For the past 2 years entomologists have carried out extensive tests on some of the newer more promising insecticides, and with materials to synergise the available pyrethrum and rotenone sprays and dusts. While considerable valuable comparative data have been obtained, which have been submitted to growers, even the best materials do not give the consistent results desired. Therefore, work on insecticides, particularly with the newer materials, will be continued. (*Project H-26-6*)



Experimental duster, left, and sprayer, right, developed for research studies on control of the Mexican bean beetle.

Control of Tobacco Insects Under Study

The most important tobacco insects in Maryland are the tobacco hornworm and an aphid commonly called the green peach aphid. It has not been feasible to arrange plot work under controlled conditions for either of these pests since infestations are erratic and unpredictable. However, studies of control measures for these two insects have been made where infestations have made it possible.

The first brood of hornworms can be effectively controlled with an application of arsenate of lead. Since the second brood of worms occur in August and September when ground equipment cannot be used airplane applications of insecticides to mature or nearly mature crops have given best results. The principal problem in treating large tobacco with airplanes late in the season is visible residues at harvest.

Airplane applications of parathion to tobacco has proved a fairly efficient method of controlling the green peach aphid. (Project E-40)

Control of European Corn Borer By Parasites and Insecticides

As a result of a steady increase in the damage done by the European corn borer entomologists have intensified their work on this destructive corn pest.

A survey is made in every Maryland county each fall to determine the prevalence and distribution of corn borers and the parasites that destroy them. These surveys help entomologists determine where to release parasites.

The fly parasite, *Lydella stabulans griseus*, has been established throughout Maryland. It destroyed approximately one-third of the over-wintering brood of borer larvae during the spring of 1951. Several wasp parasites are also being released in Maryland. One of these wasps, *Macrocentrus*

gifuensis, has become established on a small scale in Cecil, Harford, Baltimore, Carroll, Howard, Montgomery, and Frederick counties. Parasitism by this wasp ranges from traces to as much as 10 percent of the over-wintering brood of borers.

The results from a spray program designed to control all corn pests including the corn borer indicate that it is profitable to spray canning corn during the latter part of the season when earworm and fall armyworm are the most abundant. These sprays have largely eliminated the contamination by the corn borer and the cost of processing is reduced sufficiently to largely offset spraying costs. (Project H-43)

Spraying Equipment Devised for Corn Insects Proving Successful

In 1947 the Entomology Department, in cooperation with a commercial sprayer company, several canners, and four Maryland county agents, pioneered in the development of some practical high clearance equipment for spraying corn to control the Japanese beetle and the European corn borer. These machines were perfected in 1948 and 1949. The final product was a fast moving, high clearance spray machine that would cover 50 to 100 acres of corn per day at a cost of approximately \$1.50 per acre per application. Today a number of farm machinery manufacturers are building similar spray machines.

During 1950 these same machines were used to study low gallonage sprays. Entomologists found that it is possible to control the Japanese beetle with as little as 5 gallons of water plus the insecticide per acre. Corn borer has been controlled with as little as 15 gallons of water plus the insecticide.

The Entomology Department is also pioneering in the study of low gallonage spraying with the mist blowers, fog applicators and microsol sprayers. (Project H-43)



Experimental spraying for control of sweet corn insects to determine practicability under commercial conditions.

Tests with Low Gallonage Spraying To Control the Corn Borer Are Promising

Entomologists have known for many years that the corn borer could be controlled by applying insecticides such as DDT or Ryania in 100 to 150 gallons of water per acre but the cost of spraying was excessive. This gave rise to the need to develop a spraying procedure that required the use of much less water per acre.

Work on this phase of corn borer control was started in 1947. Results to date indicate that up to 90 percent control can be obtained with water rates as low as 20 to 25 gallons per acre and two to three spray applications per season. Several different kinds of insecticides are now being tested with water rates ranging from 5 to 30 gallons per acre. Along with this, studies are being made on the timing of the spray applications, with the hope that the number of applications can be reduced, thereby reducing the cost. At this point there seems to

be a possibility that the number of applications can be eventually reduced from four or five to two, and possibly one. (*Project H-41*).

Peach Insects

Studies on the effectiveness of the newer chlorinated hydrocarbon insecticides on the control of peach insects are in progress at the Hancock laboratory. Effective methods have been developed for the control of the plum curculio and the oriental fruit moth. The general use of DDT has so reduced the peach tree borer that suitable experimental plots are now difficult to find in the Hancock area. (*Project H-55 A and B*)

New Insecticides Studied For Control of Fall Armyworm

In an attempt to find more effective insecticides for killing the larger armyworm larvae, laboratory studies were made by the department to gather information on the relative effectiveness of the different insecticides. Among



Codling moth and other fruit insects receive intensive study at the Hancock laboratory.

the more promising insecticides were DDT, parathion, lindane, and dieldrin.

Along with the spray tests for the fall armyworm, tests were also conducted to evaluate the effectiveness of the several insecticides for killing the corn earworm. Fall armyworms were found to be easier to kill than corn earworms. The best results were obtained when the insecticides were formulated in emulsions fortified with superior oil. The most effective of the insecticides were parathion, lindane, dieldrin, and DDT. Only parathion and lindane was effective in killing 100% of the large worms. Young larvae were killed rather easily by all the insecticides. (*Project H-35*)

Findings Show Milky Disease Reduces Japanese Beetle Population

Along with milky disease establishment work research is conducted to acquire further facts about the efficiency of the disease in controlling the beetle. This work is being done in cooperation with the Bureau of Entomology and Plant Quarantine.

A summary of seven years of data assembled by the Bureau of Entomology and Plant Quarantine showing Japanese beetle population on 100 acres of turf at the Veterans Hospital, Perry Point, Maryland shows an 86 to 94 percent reduction in beetles.

Data taken on any other areas in the state show similar results. Once an area becomes thoroughly infected with milky disease Japanese beetle survival has been found to be negligible. (*Project H-41*)

Japanese Beetle Parasites Destroy Grubs

The Japanese beetle parasite *Tiphia vernalis* is being colonized in all parts of Maryland as a control for the beetle. Releases have been made on 925 sites in an effort to study the influence of these parasites on Japanese beetle populations. The build up in parasites is now gaining momentum and there are many strong flourishing colonies.

The effectiveness of the parasite varies with the strength of a colony. In

areas where parasites have become established, 20 to 60 percent of the grubs are being destroyed. In areas where there are exceptionally strong colonies the destruction of beetle grubs is much greater eliminating between 50 to 70 percent of the grub population in some areas. (*Project H-41*)

Insecticides for Japanese Beetle Control

Within recent years DDT has been generally used to control the Japanese beetle, but it is neither desirable or feasible to use DDT for all situations.

Both field and laboratory tests made in the last 2 years show that DDT, BHC, Lindane, Parathion, Aldrin, Chlordane, Methoxychlor, Rothane, Dieldrin and Toxaphene were effective either as emulsions or wettable powders, for killing Japanese beetles.

Satisfactory control was obtained in the field with DDT, Methoxychlor, Rothane, Chlordane, Toxaphene, Dieldrin, and Aldrin at a dosage level of 1 pound of technical material in 100 gallons of water. Effective control was obtained with both wettable powders and emulsions in the case of all the insecticides except Aldrin and Dieldrin which were not tested as wettable powders.

Rapidity of knockdown or paralyzing effect from the different insecticides varied widely. The insecticide that gave the most rapid knockdown was the gamma isomer contained in BHC and Lindane. Other insecticides that gave rapid knockdowns were: Methoxychlor, DDT, Rothane, and Parathion. The knockdown from Chlordane, Dieldrin, Aldrin and Toxaphene was slow and gradual, but ultimate kills were good.

The use of some of these insecticides, especially methoxychlor, provides opportunity for controlling Japanese beetle on certain crops and avoiding the undesirable residues associated with DDT. (*Project H-41*)

Lice on Livestock

Approximately 70 percent of the cattle herds that entomologists examined were infested with lice. Not all of the animals in the herds where lice were found harbored lice, but it was estimated conservatively that 40 percent of the animals in the state were lousy at one time or another during the year.

Surveys show that lice usually become noticeable in late fall. Infestations are usually quite well established by late December, with heavy infestations on untreated animals during the winter months. Spraying with either DDT or benzene hexachloride was found to be effective for freeing cattle of lice. When dairy cattle are involved rotenone or methoxychlor is suggested for treatment. Outstanding results were obtained with BHC for freeing hogs of lice. This material is also outstanding as a remedy for eliminating mange mites. Swine producers in many parts of the state are now using BHC. (*Project H-52*)

Better Insecticides Being Sought to Control Flies

Since the initial work was done flies have developed some resistance to DDT and some of the other insecticides. The fly control problem is further complicated by a ruling from the Food and Drug Administration that no trace of DDT is permitted in milk or meat that is offered for sale. Last year, however, entomologists worked out an effective, simplified program for controlling flies that also complies with all Food and Drug regulations.

Some of the new and promising insecticides now being tested are: methoxychlor, benzene hexachloride, dieldrin, aldrin and special combinations of all of them.

Entomologists Working to Simplify Home Gardener's Job of Controlling Insects

Home gardeners have found the job of controlling the many garden pests to be difficult, somewhat confusing, and generally rather expensive in terms of time and money. Because the job is so complex, severe losses in the garden often occur.

Maryland entomologists are developing a liquefied gas aerosol method of applying insecticides simultaneously from the same dispenser. If this "one-package" spray is successful as it now looks like it might be, home gardeners can look forward to an easier job with insects and diseases. (*Project H-46-a*)

Pests That Annoy Man—Mosquitoes, Flies, Ticks—Being Controlled By Cooperative Work with Cities and Towns

Mosquitoes, flies and ticks present a serious control problem in many city and urban communities. The conventional method of spraying, while effective in controlling the pests, is quite expensive especially in labor and time.

Three types of machines have been tested in space spray work; namely, fog applicators, Hession microsols sprayers, and mist blowers. Satisfactory mosquito and fly control have been obtained with all of these machines.

Studies on Nursery Insects Continue

Experiment Station entomologists are continuing their studies on several insects that affect nursery crops. The boxwood psyllid, mimosa webworm, tulip and magnolia scales, and azalea pests are a few receiving study.

Azaleas are becoming increasingly popular with homeowners, but are subject to serious damage by the spider mite, the leaf roller, a white fly, the azalea lace bug, and two or more scale insects. An effective control program

has been developed for insects that effect the azalea. (*Project H-35*)

Nectar Resources of Maryland

Nectar is a state resource which can be collected economically and in quantity only by the honey bee. This project recently started is designed to determine the location of fairly large areas of nectar secreting plants; the average date of bloom; the average duration of bloom; the intensity of the nectar flow; and the quality of honey produced in the particular area. (*Project H-53*)

New Method For Control of Orchid Pests Devised

An adequate, economical and safe spray of emulsified DDT has been developed to control orchid pests. It has been generally accepted by the commercial orchid growers and is proving highly satisfactory.

Research work is also progressing satisfactorily on the control of snails, the mites on African violets and several new mites on orchids. (*Project H-50*)

A Monographic Study of the Coccid Family Aclerididae (Homoptera) Completed

The numbers of this small family of scale insects is of world wide distribution, and are frequently encountered on plants that are imported into this country. In the past it has not been possible to identify most of them. This study was aimed at making it possible for entomologists to identify correctly these scale insects. Material of as many known forms as possible were assembled, studied and a classifications scheme devised that will make possible their identification. Forty-one species were treated: twenty of them are native to North America and twenty-one are exotic. (*Project B-54*)

The Patuxent River Project Continued on the Effect of Soil Conservation and Game Management Practices on Plant and Animal Life

This is an extensive long time project being carried on in cooperation with the U. S. Fish and Wild Life Service and the Soil Conservation Service. Two farms are being used in this work; one is being managed in the conven-

tional manner and the other by the latest soil conservation practices. Maryland Experiment Station entomologists are observing insect abundance on the two farms to determine the effect of these management practices on injurious and beneficial insect species. It will require a number of years of observation before definite conclusions can be drawn. (*Project H-56*)

Horticulture

Many research studies on production problems of vegetables, fruits, and ornamentals and on processing of horticultural crops and measuring food quality are now being carried on by Maryland Agricultural Experiment Station workers in horticulture. Much of the vegetable field research work is being done at the Vegetable Research Farm near Salisbury. Among things being studied there are fertilizer application rates, effects of irrigation on vegetable crops, cultural practices, etc. Some vegetable work is also being done at the Plant Research Farm at College Park.

Most of the research work with fruits crops is being done at the Plant Research Farm. The Experiment Station also has a Fruit Laboratory at Hancock, Maryland.

Several horticulturists are doing extensive research on ornamental crops

such as studying fertilizer application rates for hydrangeas and poinsettias, propagating plants by cuttings, etc. Most of this work is done at the greenhouses and laboratories at the main station at College Park, as are the preliminary phases of many other horticultural studies.

Other researchers are working on various instruments and methods for measuring more accurately and objectively the quality in foods such as tomatoes, peas, beans, and sweet corn. They are also studying methods of concentrating tomato and apple juice by both canning and freezing methods.

In addition to the work at these research centers, many horticultural crops are being tested more extensively under field conditions on the farms of cooperating farmers throughout Maryland, all of which means better horticultural crops for Maryland people.

Vegetables

Newer and Better Varieties of Vegetables Being Tested for Maryland

New varieties of vegetables are constantly being introduced by plant breeders to get higher yields, better quality or disease resistance. One of the most important phases of the horticultural research program is the testing of these varieties under Maryland conditions.

PEAS: Three varieties of the Alaska type peas were tested at College Park. Supergreen was found to have a lower growth rate with response to temperature than either Superlaska or Alaska. Supergreen was higher in chlorophyll and yellow pigment content and lower in alcohol insoluble solids content than Superlaska or Alaska. The 1950 yields were highest for Superlaska.

WATERMELONS: Eighteen varieties and hybrids of watermelons were

grown at Salisbury. The varieties Coker, Wilt-Resistant Garrison and Hawkesbury were of the highest quality. None of the hybrids were better than those varieties, and several were consistently poorer.

LIMA BEANS: Two nematode-resistant types of lima beans were grown in comparison with Henderson and Triumph, at Salisbury. No difference was observed in yield or quality of the two resistant types and Henderson. Triumph yielded less than 50 percent as much as Henderson.

SNAP BEANS: Ten varieties of snap beans were grown at College Park. Topcrop was again one of the highest yielding varieties. Other types still under the breeder's number were found to be equal or superior to Topcrop in yield and concentration of set.

NEW SWEET POTATOES VARIETIES BEING TESTED: Recently introduced varieties and strains of both Porto Rico and Jersey type sweet potatoes are being tested to find a Porto Rico type suitable to Maryland conditions and to find a variety that has the good qualities but not the bad qualities of Maryland Golden. Allgold, a variety from Oklahoma, is especially promising and selections from Maryland Golden in tests at the Vegetable Research Farm were outstanding. (*Project Q-74*)

Breeding Tomatoes and Cantaloupes Better Adapted for Maryland Conditions

The tomato breeding program has been aimed primarily at producing varieties with greater resistance to cracking and to late blight infection than the present commercial varieties. In this program 140 lines have been self-pollinated, and 20 crosses and back-crosses were made between strains and varieties known to be desirable genetic material. Certain lines were found to be desirable for use in the production of F_1 hybrid types. Lines Md-6 and Md-16, shown in 1949

to have considerable resistance to fruit cracking, to be of exceptional color, to be high yielding, and to have a high degree of resistance to Fusarium wilt, were increased for final trials during 1951 with interested canners in various sections of the state. The marked absence of cracking of these strains will probably make it possible for the canning industry to use a mechanical coring device.

It is believed that seed stock of these superior strains can be built up in sufficient quantities, so they can be named and released for general commercial planting within another year. (*Project Q-82*)

Cantaloupes of higher sugar content and greater resistance to defoliation by diseases, are badly needed by Maryland growers. As a long-range approach to the development of superior varieties, breeding work was initiated several years ago, with the result that there are now under test a number of promising selections. These combine higher sugar content and greater resistance to defoliation. Foreign material is being tested in search of germ-plasm possessing outstanding desired characters. (*Project Q-81*)

Fertilizing Tomatoes with Foliar Sprays to Decrease Premature Defoliation

Yields of tomatoes in Maryland are often greatly reduced because of early defoliation of the plants. This defoliation is caused by disease, or by lack of fertilization, or often a combination of the two. Foliar sprays containing mineral nutrients have been found effective in supplying quickly available nutrients and hence improved growth in some types of plants. To determine the effectiveness of this method with tomatoes, foliar sprays containing magnesium, boron, calcium and other minerals singly and in combination, were applied in a field test at the Vegetable Research Farm, Salisbury. Although results showed neither differences in

yields or in defoliation due to the foliar sprays, the tests are being continued in 1951 with more frequent applications and new formulations of nutrient sprays. (*Project Q-79E*)

Sweet Potato Fertilization Studies

Producing high yields of sweet potatoes on the sandy soils of the commercial areas in Maryland requires heavy applications of fertilizers containing high potash percentages. As a basis for application rate and timing of fertilizer applications a study was made of the seasonal growth and fertilizer uptake by the sweet potato. Analyses show that a 368 bushels per acre crop had an uptake of 103 pounds nitrogen (N); 40 pounds phosphorus (P_2O_5); 200 pounds potash (K_2O); 30 pounds calcium (CaO) and 12 pounds

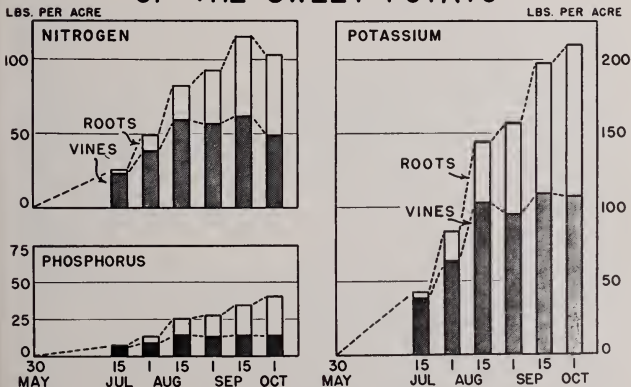
magnesium (MgO). About half of the nitrogen, phosphorus and magnesium and two-thirds of the potassium are present in the root crop and thus removed permanently from the soil.

Field plot experiments at the Vegetable Research Farm at Salisbury have shown that increases in yield were obtained with increased potash application to 325 pounds K_2O per acre, which is well above the usual rate applied. Addition of magnesium to the fertilizer also increased yields. The use of boron did not affect yields and also had no effect in prevention of cracking—a relationship that had been reported to exist. (*Project Q-79F*)

Sweet Potato Cracking Problem Being Attacked

In 1949 it was estimated that from 30 to 50 percent of the commercial sweet potato crop in Maryland was

SEASONAL MINERAL UPTAKE OF THE SWEET POTATO



These data show that the sweet potato uses about 40 percent of its required nutrient supply in the first half of the growing season, largely in producing vine growth. About 60 percent is required during the last half and is used almost entirely in production of the storage roots.

made unmarketable because of cracking of the roots in the field before harvest. Although losses in that particular season were unusually severe, cracking has caused damage to the crop to some extent in every season. Field and greenhouse experiments were undertaken in 1950 to determine the cause of cracking and to develop a method of prevention. These experiments have included studies of the effects of soil moisture, fertilization, soil fumigation, plant spacing, time of planting and variety upon the degree of cracking.

Varying the amount of moisture in the soil during the period of root formation by supplying irrigation and by protection of plots from rainfall failed to cause any difference in the cracking obtained. Similarly it was found that fertilization had no direct influence on cracking. Cultural tests such as time of planting, spacing, and type of plant have shown differences in the amount of cracking but these effects seem to have been indirect through their association with growth conditions existing in the several tests.

The most promising treatment found so far is treating the soil with a soil fumigant before planting. DD (dichloropropene-dichloropropane mixture) applications definitely decreased cracking. Whether this effect is through control of nematodes, diseases, or other factors is not as yet known. The principal objection to soil fumigation is the cost, which is from \$30 to \$50 per acre.

Varietal tests have shown that there are great differences in susceptibility to cracking among varieties. Unfortunately the state's leading commercial variety, Maryland Golden, is one of the most susceptible. A large number of newer varieties and strains are being tested to find a variety that will replace Maryland Golden. (*Project L-74A*)

Vegetable Crop Management Problems Under Study

In the production of vegetable crops growers bring up a number of questions concerning the best method of crop management, such as spacing, planting methods, cultivation, weed control, etc. Answers are best given on the basis of experimental trials carried on at the University Research Farm or on growers' farms. The following are brief statements of the results of such trials in the past year.

Plant Spacing of Tomatoes and Sweet Potatoes: Tomato plants spaced 3.5 ft. apart in 3.5-foot rows gave higher acre yields than plants 3 ft. apart in 6-foot rows. Different row spacings of sweet potatoes demonstrated that 15 inches between plants is most desirable for the Maryland Golden variety, unless a higher yield of canning-sized potatoes is desired when plants should be spaced about 10 inches apart.

Delayed Planting Reduces Yield of Sweet Potatoes: Planting sweet potatoes after May 20 caused an average decrease in yields of about 35 bushels per acre for each week's delay.

Hormone Applications Not Effective in Preventing Sprouting of Sweet Potatoes: Applications of the growth regulators, 2,4,5-T, maleic hydrazide and MENA both as sprays on the plants before harvest and as treatment of the roots after digging did not prevent sprouting during storage. 2,4,5-T and maleic hydrazide caused injurious effects.

Weed Control in Peas, Sweet Corn and Spinach: Application of cyanamid at rate of 275 pounds per acre 4 days after seeding shows promise as a method of controlling weeds in peas. Cyanamid plots have also given higher yields. The use of 2,4-D at the rate of $\frac{1}{2}$ pound per acre when corn is 6 inches high or 400 pounds of cyanamid three or four days after planting gave



Control of soil moisture by irrigation is one phase of the work in sweet potato cracking at the Salisbury Vegetable Research Farm.



Control of soil moisture by protecting sweet potato plots from rainfall is another phase of the sweet potato cracking work.

practical weed control in sweet corn. Here again the cyanamid increased the yields.

Attempts to control the spring growth of weeds in fall planted spinach were made by use of cyanamid and IPC. Cyanamid at rate of 400 pounds per acre 4 to 7 days before seeding gave injury. IPC killed weeds but also damaged spinach.

Cauliflower New Commercial Crop in Western Maryland: Trial plantings in 1950 indicated that soil and climate in certain areas of western Maryland were well adapted to production of cauliflower. In 1951 variety and fertilizer tests with the crop are being conducted with growers in Garrett County.

Hormone Sprays did not Increase Pod Set of Snap Beans in 1950 Tests: CLPA and CLPP applications in three varieties of snap beans failed in influence pod set or yield. Effects from using such hormones seems to depend upon weather conditions, in particular moisture relationships. (Project Q-77)

Control of Ripening of Vegetable Crops with "Growth Regulator" Chemicals

Very frequently fruit and vegetable

processors find that abnormal weather conditions force growers to bring in the raw material such as tomatoes and sweet corn in such large quantities that the processing plant cannot keep up with the processing. Thus they must either process the material hastily, or fall behind their schedule and process material that is more mature than desired, or discard large quantities of the raw material.

It was hoped that by using certain chemicals the rate of maturation of crops in the field could be slowed down so that processing operations could "catch up to the weather." Most of the results thus far have been negative for peas, sweet corn and tomatoes. It was found that the maturation of lima beans could be hastened to some extent but not retarded. The best results were obtained with snap beans where the seed and fiber development could be substantially retarded. Therefore it is possible for a processor to spray snap beans in the field and slow them down if he finds that the material is coming into the plant more rapidly than the plant can handle it. (Project Q-58-F)

Fruits

Leaf Analysis Proves Accurate Guide to Orchard Fertilizer Needs

Instances of nutrient deficiencies in fruit planting that have seriously affected growth and fruiting are being found in the several orchard areas of the state. Since a number of factors determine the orchard's nutritional requirements, including variety, soil type, cover crop, tree age, etc., a broad fertilizer recommendation cannot be made. Chemical analyses of leaves to determine levels of the various essential elements have been found the best measure of the nutrient condition of the trees, and the most accurate index of the tree's response to a given ferti-

lization program. Such studies have been made during the past several years and were continued in 1950. Some of the more important recent findings may be summarized as follows:

Fertilization of mature York and Stayman apple trees with heavy amounts of potassium has not caused the appearance of magnesium deficiency as has been the case in some other orchard areas. Similarly heavy magnesium applications have not caused potassium deficiency.

Magnesium deficiency in grapes has been diagnosed and corrected with fo-



Interveinal yellowing or chlorosis of the older leaves of grapes has been found to indicate magnesium deficiency. Tests show the trouble can be corrected in the vineyard by spray applications of magnesium sulfate onto the leaves or by soil applications of magnesium sulfate or dolomitic lime.

liar sprays or soil applications of magnesium sulfate. These studies have also demonstrated certain phases of magnesium nutrition of general application to plants. Tests are now in progress with blueberries on a similar deficiency problem.

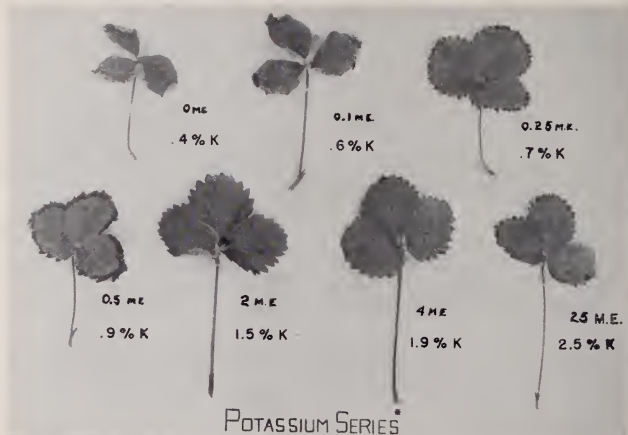
Leaf samples collected from both apple and peach orchards throughout Maryland have been analyzed. In certain instances analyses have formed the basis for recommendations for specific fertilizer application to correct or prevent deficiencies. Also, of perhaps equal importance, a clear recommendation for omitting unnecessary fertilizers is now possible with this method of diagnosis. (*Project Q-79B*)

Strawberries Are Sensitive to Lime, Potassium, and Magnesium

It has been known that the strawberry often responds unfavorably to lime applications in the field. Liming

in sufficient quantity to decrease acidity of the soil to a level favorable for plant growth has killed young strawberry plants. Preliminary greenhouse tests have shown that this sensitivity of the strawberry applies not only to calcium, but also to potassium and magnesium. In a series of plants growing at different calcium levels, normal plants developed only under a very limited range of calcium nutrition; at the lower levels definite deficiency symptoms developed, while at higher levels toxicity appeared. Similar situations were found in the potassium and magnesium series. In fact the symptoms of magnesium deficiency and magnesium toxicity in the strawberry are remarkably similar, so much so, that only determination of the concentration of magnesium in the plant by analyses can distinguish which it is.

This work has formed the basis for field studies to determine optimum nu-



The strawberry is very sensitive to both deficiencies and excesses of nutrient elements. Note abnormal leaves formed in sand culture containing less and more than 2 millequivalents potassium in the nutrient solutions. Corresponding potassium concentration in the plant is given in percent.

tritional levels in strawberry plantings in Maryland. (Project L-79A)

New Fruit Varieties for Maryland Orchards

Both apple and peach variety plantings were extended considerably by adding newly-named introductions. Many of the varieties previously planted bore fruit for the first time, thus permitting evaluation of quality, size, color, yield, adaptability for freezing, etc. Several hundred varieties are now under test.

Newer varieties of peaches that have shown unusual promise in the planting at the Research Farm for several successive years, were set with cooperating growers in two sections of Western Maryland for further trial and direct grower observations under commercial conditions. The Redskin variety, intro-

duced in 1944 by the Maryland Experiment Station, has shown great promise in some commercial areas.

The raspberry variety trials under grower cooperative test were continued in Washington County. The newer black-cap variety, Dundee, continued to show exceptional merit. A new cooperative planting of black raspberry varieties was established during the year in Garrett County with the purpose of determining the possibilities for successful commercial production in this westernmost area of the state. (Project 1-73)

Practicability of Chemical Sprays for Thinning Apples and Peaches After Bloom

The labor required in thinning tree fruits in the usual manner is becoming an increasingly costly item in fruit pro-

duction. With most varieties of apples and with peaches the use of chemical sprays in the bloom period cannot be recommended for losses from late frosts may still occur. Hence a new approach is being taken, with tests underway designed to accomplish thinning by chemical growth regulators applied several weeks after bloom. Several concentrations of materials on Shippers Late peaches applied after the shuck-fall stage and on Gallia Beauty apples before the regular June drop are under trial. Further studies must be undertaken before practical recommendations can be made. (*Project L-74*)

New Cover Crops and Mulching Improving Orchard Soils

Studies were continued with the new cover crop mixtures devised for Mary-

land orchard soils. One combination consisting of crimson clover, winter rye, winter vetch and Wong barley at the rate of 8 pounds of each per acre again produced 5 tons of dry matter per acre in commercial peach orchard trials and is being extensively adopted by growers.

The work on improved sod-type covers for apple orchards was continued. Mulching studies as a possible means of alleviating fruit cracking in Stayman Winesap were initiated in a commercial block in Western Maryland and should provide preliminary observations during the 1951 harvest. (*Project L-74*)

Improvement in Fruiting of Richared Delicious Apples

The various treatments under study



Large, high-yielding peach trees are being grown in the Research Farm orchards under a combination mulch and permanent sod system of soil management.

for several years which have included three levels of pruning, three levels of nitrogen, girdling, fruit thinning, etc. were continued. Earlier results were again substantiated and especially reveal that for optimum growth and high yields this variety requires distinctly heavier applications of nitrogen fertilizer than have been heretofore recommended or are now being conventionally used. Boron sprays designed as a possibility to influence the set of fruit with this variety proved ineffective. (Project L-74)

Raspberries Adaptable to Maryland Climate—A Result of the Fruit Breeding Work

The commercial raspberry industry of Western Maryland has never had a fully adapted red raspberry variety. Unreliable response to Maryland's open-type of winter has resulted in frequent injury with lowered yields and quality. When tests of various changes in cultural practices showed no promise in remedying the problem, breeding was begun to provide a variety tailor-made to meet Maryland's requirements. The first of several planned introductions is being released this year under the name Antietam. It has withstood nine consecutive winters without injury and is of good size and quality. Fortunately it is an early ripening variety that will also avoid the spray residue problem on the fruit incident to Japanese beetle control. Usually, most of its crop can be harvested before the beetle emerges. Planting stock will be available in ample quantity in another year.

The work under this project continues. Records were obtained on ap-



Available fall-bearing, red raspberry varieties fruit too late and sparingly in Maryland to be grown generally. New hybrids such as the heavy bearing Maryland selection photographed August 7 are being bred to meet Maryland requirements.

proximately 5,000 new seedlings from many different crosses fruiting for the first time this spring. About 4,000 seedlings were grown and set in the field recently. These will fruit in the spring of 1952. In addition many new crosses were made in the greenhouse that will provide seedlings for evaluation and selection during the spring of 1953. European varieties and Asiatic species are represented in the recent parentage in an effort to introduce still better size and freezing quality of the fruit and greater disease and drought resistance of the plants. The program has been expanded also to include work on the development of superior black varieties for Maryland conditions. (Project L-73)

Floriculture and Ornamentals

Nitrogen Most Important in Producing Pink Hydrangea Flowers

The commercial demand for greenhouse-forced hydrangeas is for plants with large, clear pink flowers and dark green leaves. Under Maryland conditions hydrangeas often produce less desirable flowers unless special treatment is given.

An experiment in the summer of 1950 was designed to study the effect of different levels of nitrogen, phosphorus, and potash fertilization on growth and on formation of flower buds. Half of the plants in each of these treatments were grown in partial shade as is recommended in the mid-west area of the United States.

It was shown that without adequate fertilization the growth in the partial shade was taller than in full sun, but that adequate fertilization of the plants in full sun resulted in plants of a size and quality more desirable than those produced in partial shade. Moderate amounts of nitrogen fertilizers were found to be necessary for adequate growth and flower formation, but the highest rates of nitrogen used resulted in a too rapid development of the flower and a plant that was too tall and of poor quality. Phosphorus and potash fertilization showed little specific effects.

During the greenhouse forcing period applications of nitrogen proved to be the principal requirement for best growth. Applications of phosphorus resulted in pinker flowers but the lasting quality of the flowers was seriously reduced at the high rates of application. Contrary to common belief, nitrogen fertilization was found to be most important in retaining the pink color of the flowers. Urea and ammonium forms of nitrogen were found more effective in producing dark green leaves than was nitrate nitrogen. (Project I-79B)



This disorder of hydrangea flowers resulting from the breakdown of the peduncle was found to be associated with too high phosphorus fertilization.

Low Temperature Storage Required To Break Dormancy of Hydrangeas

While hydrangeas are one of Maryland's important florists crops the conditions necessary for the formation of flower buds on hydrangeas are not fully understood, neither are the conditions resulting in the dormancy of the plant nor for the resumption of growth following dormancy. This information is of considerable economic importance to commercial florists, in the growing and forcing of this plant. Experiments have been carried out to investigate the effects of light and temperature as the two factors most likely to influence bud formation and dormancy.

Plants have been grown in refrigerated chambers using artificial light to get a greater degree of control of the light period and temperature than can be had in a greenhouse. Although light duration apparently has some effect, temperature seems to be the principal factor in controlling flower bud formation. Temperatures below 62 degrees F. are more effective in terminating dormancy than a higher tempera-



Hydrangea plants at left stored at 55° F for 20 days while dormant; plants at right stored at 70° F for same period failed to bloom.

ture. Thirty-four days at a temperature of 40° F. was adequate but at 47° F. 38 days were required while at 55° F. 49 days were necessary to give the same results. (*Project I-74A*)

Nutrition of Stock Plants Important in Rooting of Cuttings

Many of the more desirable ornamental plants are difficult to propagate by stem cuttings. Since this method of propagation is the most economical for the nurserymen, experiments are being conducted to determine factors that inhibit rooting.

It is the practice of the nurserymen to select cuttings from plants in the field. As the soil varies in each block, the nutritional content of the cutting also will vary. To determine whether or not nutritional content influences rooting, plants of California Privet were grown in sand culture and treated with all combinations of three levels of nitrogen, phosphorus, and potassium. Cuttings were taken and divided into two groups. One group was inserted directly in the rooting media and the other was first treated with a root promoting substance.



Studies show that hydrangea plants once permitted to become dormant require a definite amount of cold temperature treatment before satisfactory growth will resume. Left to right: storage for 12, 24, 32 and 40 days respectively at 45° F before placing in a warm greenhouse.

It was found that increasing nitrogen or phosphorus in the nutrient solution increased the heaviness of rooting, length, number, and dry weight of roots. The favorable response to nitrogen, as measured by number, dry weight, and heaviness of roots, was greater at high levels of potassium. Outstanding was the fact that hormone alone appeared to play the most important role in root initiation irrespective of the nutritional content of the cuttings.

Similar experiments have been carried out with azaleas. (*Project I-26A*)

Rhododendrons Successfully Propagated by Stem Cuttings

Among the ornamental broadleaf evergreens, the rhododendron is outstanding. However for the average



Bark stripping of Rhododendron stem cuttings was found to materially improve rooting (upper row) as compared to conventional methods (lower row). Variety Roseum Elegans.



High nutrient levels (upper row) in the soil of the stock plant distinctly improved the rooting of California Privet as compared to cuttings taken from soils of low nutrient level (lower row).

home owner, the use of hybrid rhododendrons is prohibitive because of the cost. At the present time, nurserymen propagate hybrid rhododendrons by grafting, a method that is time consuming and expensive.

Propagation by stem cuttings would greatly reduce cost, but in the past this method has not been successful. Research studies during the past year have shown that a wound treatment (slicing of the base of the cutting) accompanied by treatment of the cutting with a mixture of root-inducing substance and Fermate followed by waxing, resulted in approximately 80 percent rooting of stem cuttings in 6 weeks. Nurserymen feel that securing 50 percent rooting response would greatly decrease the cost of hybrid rhododendrons. (*Project I-26A*)

Fertilizing Poinsettia Stock Plants To Increase Propagating Value

Poinsettias, the most important flowering plants for Christmas, are propa-

gated by cuttings taken from stock plants during the summer. These stock plants are grown in California and shipped to the eastern florist in April. The cost of the stock plants each year is important in the total cost of production of this crop by Maryland florists. Thus it is important that they secure the maximum number of cuttings from these stock plants.

Experiments have been conducted to determine the best fertilizer practices for poinsettia stock plants. Eighty-one stock plants were given 27 different fertilizer combinations. Cuttings from these plants were rooted and the young plants grown to maturity in the greenhouse.

Increased amounts of nitrogen fertilizer favorably increased the number of cuttings produced, the ease of rooting of the cuttings, and the number of flowers produced, but it slightly delayed the date of bloom. The nitrogen applied to the stock plants did not affect the size of flowers or the stem length of the young plants.

Increased amounts of phosphorus increased the number of cuttings produced and considerably hastened the blooming date. The moderate amount

of phosphorus produced the greatest number of plants and the greatest number of flowers; the highest amount had a depressing effect on the rooting and consequently a decreased production of cuttings and a decrease in the flower size.

Increased amounts of potassium resulted in more cuttings and a slightly earlier date of bloom. (*Project I-74A*)

Fertilization of the Azalea

Azaleas are of interest to the nurserymen and florists of Maryland both as an outdoor ornamental plant and as a flowering plant for greenhouse forcing. It has been the common belief that only special fertilizers, particularly those from organic sources should be used on azaleas and that these should be used sparingly.

Several fertilizer programs are being tested which include the use of commercial fertilizers as well as the use of several intensities of nitrogen, phosphorus and potassium fertilizers alone and in combination. Studies also are being conducted using different soil mixtures along with the fertilizers in the growing of these plants. (*Project I-79A*)

Processing

The Maryland Shear-Press Measures Three Qualities in Foods

In recent years many instruments have been developed to measure such factors as hardness, mealiness, juiciness, and fibrousness of foods. Many of these instruments have not been sufficiently precise, and can be used for only one product. For example, the tenderometer is a \$1,000 machine weighing about 500 pounds, that measures only the hardness of raw peas. Furthermore, this tenderometer cannot be standardized easily.

Basically, there are only three principles involved in this type of measure-

ment. These are: (1) shear-pressure, which simulates the resistance offered by the food to the crushing action of the teeth, (2) shearing, or cutting, and (3) succulence, which simulates the amount of juice that is squeezed out of a food during mastication. All these measurements require the application of force; hence, it was logical to assume that they could all be measured with one power unit. An instrument called the shear-press was therefore designed and built as a point project with the Department of Agricultural Engineering employing different test cells to accomplish the three different types of testing.

Experimental results obtained thus far indicated that test cell #1 measures accurately the hardness of peas, lima beans, horticultural beans, tomatoes and strawberries. Of course the range of values are entirely different for these products, so that different gauges were required. Using a different test cell, the fibrousness of asparagus and green beans can be determined, while using a third test cell the succulence of sweet corn, potatoes and apples can be measured.

The potential importance of this type of instrument was indicated, when two processors indicated that they could have saved \$150,000 and \$200,000 respectively on one crop of lima beans alone if they could have had the above instrument available during the past season. This work is supported by regional marketing funds, and by the USDA who supply official graders to help with this program. (*Project Q58-F*)

New Measurements For Determining Sweet Corn Quality

For many years various methods have been recommended for measuring quality of both canned and frozen sweet corn. Some of the methods, however, appear to be satisfactory only when weather conditions are "normal" and when a single variety is used. No single method was found which gave good results under all conditions. After considerable study it was concluded that the quality of sweet corn could not be based on one method. However if succulence (or moisture) pericarp (skin) content and kernel size are measured the general quality of sweet corn can be determined accurately. Simple methods have been developed for measuring these three qualities, and charts have been worked out so the quality control operators in canning and freezing plants can make these tests. The information on these charts enables the quality control op-

erators to determine the quality of the raw corn when it arrives at the plant or at any time in the procedure of processing. For the first time the quality of the finished product either canned or frozen, can be predicted with a good degree of accuracy. (*Project Q58-F*)

Measuring Color in Foods Is Important in Determining Quality

Although people think of food quality largely as a matter of flavor, actually the marketing of many food products depends largely upon appearance, which in turn is considerably affected by color. Tomatoes are good examples where color is undoubtedly the most important factor of quality. It has been definitely established that human evaluation of color is a relative matter; thus a grader grades tomatoes too severely if they are uniformly good, and too liberally if they are uniformly poor in color. It is therefore essential to have an objective, mechanical method to measure color if the grade is to be consistent.

In the past, methods were developed under this project that involved the extraction of the characteristic pigments, and their clarification and measurement by spectrophotometric methods. Although these methods were satisfactory for laboratory use, they were not entirely satisfactory for practical use in the food industry. Hence work is now in progress in cooperation with several optical firms on the development of photoelectric instruments that will measure directly the color of foods. Thus far two such instruments have been developed and are now under study. One, the Hunter color-difference meter, is completely automatic and extremely precise, but relatively expensive. The other, the Lumetron reflectance meter is semi-automatic, not as precise, but much less expensive. Tables have now been worked out for tomato juice and ketchup that indicate what the instru-

ment readings mean in term of U. S. grades. Additional work is in progress to establish ranges of values for peas, lima beans and sweet potatoes. (*Project Q58-F*)

Standards of Quality for Frozen Foods Now Being Developed

The freezing industry is relatively new and therefore has only recently received the attention of the food and drug administration with respect to establishing mandatory standards of quality.

The National Association of Frozen Food Packers are supporting work at the Maryland Station to develop objective, scientific data upon which quality standards may be based. Work is now in progress on the development of such standards for frozen peas and asparagus.

Several methods of determining enzyme activity, acetaldehyde, total and alcohol insoluble solids, and physical measurement of size, density, and color are being studied. Identical samples are also submitted to national taste testing panels. (*National Association of Frozen Food Packers Project.*)

Tomato Juice Can Be Concentrated

The improved quality of citrus juices resulting from development of frozen concentrates has introduced new and serious competition for tomato juice. Concentrating tomato juice would result in decreased costs of containers and transportation, and would greatly improve the economic position of this product.

It has been found that a very high quality concentrate can be obtained by reducing the freshly extracted juice to

one-fourth of the original volume by using vacuum and temperatures of 110° to 115° F. More acceptable tomato juice flavor is obtained by heat-processing the juice after concentration. This makes it possible to store the concentrated juice for long periods at room temperatures without losing quality.

How to retain the ascorbic acid (Vitamin C) in the concentrated juice constitutes a problem. The best retention has been accomplished by inhibiting enzyme activity by heating the freshly extracted juice to 200° F. for one minute before concentration. (*Project Q-58H*)

Frozen Apple Juice Concentrate

The wide acceptance of frozen concentrated citrus juices had also resulted in increased competition for apple juice. Studies made in the past year have demonstrated the possibility of preparing a concentrate of one-fourth the original juice volume, which retains its excellent fresh fruit flavor after dilution. Concentration of juice was accomplished under vacuum at temperatures of 100° to 105° F. after clarification and removal of pectins to prevent jelling.

In order to retain the fresh fruit flavor and aroma, the concentrated juice was fortified by addition of apple "essence." This essence is obtained as a condensation by-product during the concentration process.

These concentrates have been stored successfully at zero and at 32° F. In order to secure best advantage of the concentration process, studies are being made to determine feasibility of room temperature storage. (*Project L-58C*)



Broiler research house, containing 16 pens involving two systems of brooding at the experimental broiler farm at Salisbury.

Poultry

The poultry industry is another of the major agricultural industries in Maryland, concentrated primarily on the Eastern Shore in the Delmarva broiler producing area. An industry of this size calls for a considerable amount of research on such things as poultry nutrition, poultry breeding, and other important phases of the business.

Considerable progress has been made on both the breeding and feeding projects. Poultry research workers are giving intensive study to such things as

unidentified growth factors, amino acids, antibiotics, and their functions and interrelationships. Work is being done on the functions of certain body organs and their reaction to various types of treatments. Another study has been done on the influence of various methods of dressing and holding on the quality of poultry meat.

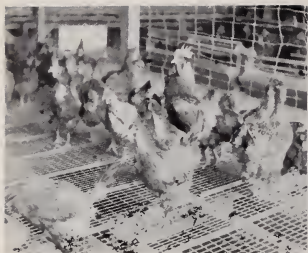
Poultry breeders at the Station are trying to develop a medium-sized turkey that combines the desirable reproductive capacities of the Beltsville Small White with the desirable growth of the large Bronze turkey.

Feeding

Chicks Require At Least Two Unidentified Growth Factors

Evidence has been obtained that clearly shows that at least two different unidentified growth factors are required by the chick. One of these factors is supplied by certain liver preparations and dried brewers' yeast, and the other is supplied by dried whey. Fish meal and crab meal also contain

an unidentified factor (presumably the one found in the liver preparations) while a butyl fermentation product contains another. The unidentified factor present in the butyl fermentation product is also supplied by dried whey and dried brewers' yeast. Antibiotic supplementation (aureomycin, penicillin, or streptomycin) of practical rations has been found to reduce the



New Hampshire breeders housed on wire floors to prevent coprophagy. These conditions are maintained in order to insure a source of vitamin B12-deficient chicks.

need for supplements containing these unidentified growth factors.

It has been shown that the unidentified factor in liver is transmitted by the dam to the chick in appreciable quantities; however, hens housed on wire floors and fed a ration containing no sources of these unidentified factors produce chicks that respond markedly to the unidentified factor supplements. Consequently, it is necessary to maintain a special laying flock in order to insure chick progeny suitable for



The three 5-week old New Hampshires on the left were fed a vitamin B12-deficient diet while the one at the right received the same diet plus vitamin B12. Note the small size, poor feathering, and generally unthrifty appearance of the chicks fed a vitamin B12-deficient ration.

use in assaying for unidentified growth factors. Studies with poult, however, have shown that this procedure is not necessary since the poult requires a dietary source of the factor present in liver even though the dams received a complete ration.

Vitamin B12 has been found to reduce the requirement for choline and methionine. The fat content of the liver increased in the absence of choline or vitamin B12. The level of essential choline required in the presence of adequate amounts of vitamin B12, methionine, and betaine was found to be .06% of the total diet.

The results of three experiments also show that green manganous oxide is satisfactory as a source of manganese in poultry rations. (*Project M-35-g*)

Feeding Trials Reveal Efficient Gains

The first broiler feeding trial conducted at the experimental farm, Salisbury, clearly demonstrated that 3-pound broilers can be grown in 10 weeks with less than 3 pounds of feed per pound of live weight. In this trial, the average 10-week weight of all birds was 3.06 pounds, with an average of 2.81 pounds of feed required per pound of live weight. The addition of either terramycin at the rate of 10 gms. per ton or an animal protein supplement (2½ or 5% fish meal or 5% crab meal), consistently improved the average weight and feed utilization. The best results were obtained, however, when the antibiotic was added in the presence of an animal protein supplement. The three groups of broilers fed terramycin and an animal protein supplement averaged 3.12 pounds with a feed requirement of 2.73 pounds per pound of live weight. The addition of terramycin also reduced mortality during the 10 weeks of this trial.

Amino Acids Have Important Role in Poultry Nutrition

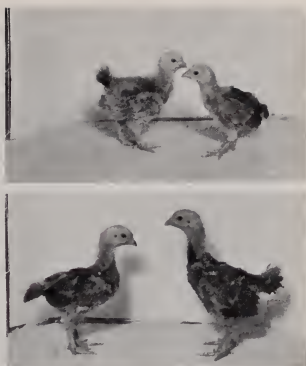
Research findings demonstrate that vitamin B12 is concerned in protein metabolism, and that there is a close interrelationship in the requirement of vitamin B12 and the level of certain amino acids. Certain amino acids has a marked effect on the requirement of the chick for vitamin B12. Conversely, the level of vitamin B12 determines in part the level of certain amino acids that may be fed without depressing growth. Since soybean-corn-type rations contain relatively high levels of leucine and glycine, amino acids that increase the need for this vitamin, the vitamin B12 requirement would be expected to be greater than in rations containing a more favorable amino acid balance.

Studies have also been conducted to determine the effect of dietary antibiotics upon the requirement of the chick for the amino acids — lysine, methionine, and tryptophan. The dietary requirement for tryptophan was slightly reduced by feeding aureomycin, but the requirement for methionine and lysine was not decreased when an antibiotic was included in the feed.

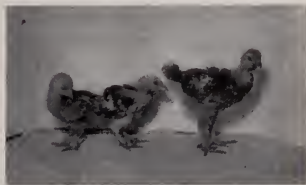
Other experiments were designed to study the effect of dietary antibiotics upon the bacterial flora of the ceca and to determine if any correlation exists between changes in bacterial types and the growth response of the chick. The evidence suggests that bacteria synthesize an unidentified growth factor(s) that is responsible in part for the improved chick growth as a result of antibiotic feeding. (*Project M-35-1*)

Search Continues for Unidentified Growth Factors for Chickens and for Bacteria

Poultry nutritionists are constantly looking for new methods and techniques to help them understand the ef-



The two New Hampshire chicks above received a vitamin B12-deficient diet while those below were given vitamin B12. In each case the chick on the right received 4% added leucine in the diet. Note that the high level of leucine inhibited growth when no vitamin B12 was supplied; whereas, no growth retarding effects were noted in the presence of an adequate intake of this vitamin.



Three-week old New Hampshire chicks. The one on the left received a diet low in tryptophan. The chick in the center was fed the same diet plus 10 parts per million of aureomycin. The chick on the extreme right received added tryptophan. The increase in size of the chick fed the tryptophan-low diet as a result of adding aureomycin indicates that this antibiotic spares the dietary requirement for tryptophan.



This shows the effect of penicillin and lactose on the size of ceca in 4-week old chicks. On the left, no antibiotic was fed. In the center, 15% lactose and 150 parts per million of penicillin were fed. On the right, 15% lactose alone was fed. Note the large size of the ceca of chicks fed lactose or lactose plus penicillin.

The contents of these enlarged ceca were watery with evidence of foam.

fects of various amino acids, antibiotics, bacteria, etc. on chickens. Since bacteria play an important part in poultry nutrition, a study is in progress to develop microbiological assay methods for unidentified growth factors for micro-organisms that might help in

isolating new animal growth factors. Efforts are being made to correlate the responses of chicks and various micro-organisms to the unidentified growth factors being studied. Another project has to do with the nutritive requirements of bacteria. (*Project M-35-K*)

Breeding

New Strains of Poultry Being Developed on Basis of Physiological Differences

For many years, poultry research men have recognized that there are tremendous differences between strains of birds in respect to their rate of growth, egg production, and other characters of economic importance, all under genetic control. The genes causing these differences must eventually show up in differences in the physiological activity of certain body organs. Already it has been shown that there

are strain differences in the response of the thyroid to induced thyroid deficiency. Distinct strains of birds are now being developed on the basis of this difference. At the same time, these strains are being studied for differences in economic characters. The project offers promise of determining some of the mechanisms which influence rate of growth, egg production, feathering, disease resistance, etc. In addition, the mode of inheritance of these characters is being investigated. (*Project M-32-K*)



Left, an albino mutant chicken that appeared in a strain of New Hampshires. Right, a creeper-type chicken resulting from the removal of the anterior pituitary gland.

Diluted Semen Used to Find Causes of Low Fertility in Chickens and Turkey Eggs

The tremendous economic losses caused by infertile chickens and turkey eggs used for hatching has focused attention upon the reproductive processes that bring about high fertility. Infertility is particularly troublesome in certain breeds of turkeys, but it also causes a tremendous loss in chicken eggs during the summer months.

Poultry researchers are using artificial insemination in their search for the answer to the problem. One of the fundamental problems involved is to determine the number of spermatozoa necessary to bring about normal fertilization. Using a diluent of natural serum of the chicken semen that was obtained by removing the spermatozoa by centrifuging, normal semen was diluted in ratios varying from 1 to 3 to 1 to 80. Subsequent comparisons showed that semen diluted as much as 1 to 10 provided fertility comparable with the natural undiluted semen. Dilutions greater than 1 to 10 gave a

marked decrease in fertility; this decrease in fertility was in general proportional to the amount of dilution. Semen diluted as much as 1 to 80 produced an average fertility of 32 percent as compared with 75 percent for the undiluted semen. The data indicate that while only one spermatozoon is actually used in the fertilization process, thousands must be inseminated to bring about normal fertility. (*Project M-33-J*)

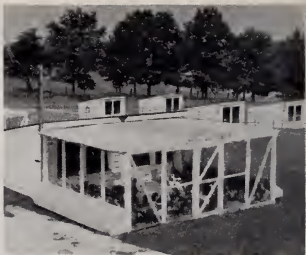
Faster Growing Small-Sized Turkeys Being Developed

The housewife has been using more turkey meat, but she has told the producer that many of the large Bronze turkeys are too large for the family. Poultry breeders in Experiment Stations responded by developing Beltsville Small White turkey. However, while this bird has a superior rate of reproduction, it does not grow as rapidly as might be desired. Now Maryland research workers are trying

to combine the desirable reproductive capacities of the Beltsville Small White turkey with the desirable rate of growth of the large Bronze turkey to get a medium-sized bird that reproduces well and grows rapidly.

Basic stock used in the formulation of the breed has included Beltsville White and Broad-Breasted Bronze bred for large size and extreme breast width. This has been the second year of selection following the original matings.

Approximately 1,000 experimental poultz were raised last year. The project will continue. (*Project M-34-E*)



There are eight of these turkey rearing houses with sun porches attached on the University poultry plant and eight breeding houses used in a research project on developing a medium-sized strain of meatier-type turkeys.

General

Hormonal Control of Economic Traits in Poultry

The endocrine system of the body produces many different hormones which exert a marked influence on many body processes. Rather recently, synthetic compounds have been developed that have hormone-like activity or depress the normal hormone activity. The thyroid gland is known to exert a marked influence on general metabolism, hence upon feed utilization and fattening. A combination of one-tenth of one percent thiouracil, a thyroid depressant, plus one gram per hundred-weight thyroprotein to the broiler ration increased the market quality of the birds and increased their feed efficiency. However, at the present price of thiouracil, the benefits would not appear to justify the cost of the treatment.

Research is also being conducted to study the hormonal and genetical factors concerned in the chicken's response to adverse environmental conditions such as cold, extreme muscular

exercise, and simulated high altitudes. These conditions elicit an adaptation response that is accompanied by a loss in weight, regression of the lymphatic tissues, and an enlargement of the adrenal gland. Since the adrenal appears to be the most directly concerned endocrine gland, the new drug, cortisone, may find a place in poultry production when it becomes commercially available at reduced prices. (*Project M-33-H*)

The Influence of Methods of Dressing and Holding on the Quality of Poultry Meat

The economic advantages of using water at 140° F. or sub-scalding when dressing certain types of poultry are known. Further work has shown that beyond the water temperature point of protein coagulation, the amount of water absorbed is inversely proportional to the temperature of the scalding water. The protein coagulation point for poultry has been found to be 142° F. \pm 2°. Poultry dressed at tem-

peratures below the sub-scalding figure will absorb as much as 25 percent of their own body weight over a 7-day period. The greatest absorption is during the first period the birds contact the cooling water.

Osmotic tests revealed that chicken skin is not a true semi-permeable membrane. Most of the water passes into the bird through the feather follicles, but fat under the skin retards this action. Fresh skin absorbed 20 percent of its own weight while under the same conditions, skin scalded at 160° F. absorbed only 2 percent. (*Project M-44*)

New Studies on the Causative Effects of Wheat in Pullet Disease

Research during the previous 2 years has indicated that "sick wheat" gives rise to pullet disease. This year, standardized solutions of aqueous extracts from "BBI" were prepared and administered daily for 28 days to six groups of susceptible pullets. Each group was fed a different diet. The results were negative, indicating that pullet disease is a physiological condition resulting from bacteria in some low germination wheats or from toxins, probably the latter. (*Project M-45*)

Changes in Grades of Eggs in Carlot Shipments in Relation to Season, Shipping Distance, Temperature, Time, and Other Factors

The object of this study was to determine quality and grade changes that

occur in shell eggs as they move through commercial market channels. It is based on the shell eggs purchased for the Armed Forces of the United States between October, 1941, and January, 1945. The data used involve the results of inspection of more than one billion eggs that were handled in 5,000 individual lots, consisting of approximately 600 cases per lot. Approximately 75 percent of all shell eggs were of grade A or better quality at the time of purchase. In moving between origin and destination, the quality of grade A's dropped to approximately 60 percent. The grade A's dropped into grade B's, increasing their average figure from 21.8 percent to 35.41 percent, but relatively few grade B's dropped down into grade C's. There were 1.20 percent grade C's at origin, which increased to an average of only 2.27 percent at destination. The time-in-transit period between origin and destination averaged 7.4 days and ranged from less than one full day to a maximum of 45 days. Quality loss was generally related to the number of days eggs were in transit, but there were many individual exceptions to this rule. Quality loss as related to distance traveled showed that the short distances had the poorest records and the longest distances, the best. Quality loss in this study was directly related to season. The lowest grade loss was in the spring and highest, in late summer and fall. Breakage was highest in the warm weather and lowest during the cold months. (*Project M-33-F*)

Rural Sociology

Rural Reading Habits Determined

The modern county library needs two kinds of aid in the field of social organization: (1) In order to set up its bookmobile routes it needs to have blocked out the neighborhoods and

communities of the county together with the various organizations and institutions that each contains. (2) It needs to have up-to-date knowledge of the reading interests and habits of people in these neighborhoods and

communities. Prince George's County was selected for a demonstration study, the outlines of which might guide local people, with some outside help, to make similar studies in other counties.

More than 3,000 people were interviewed. Assisting in the project were the U. S. Department of Agriculture, the Prince George's County Library and volunteer workers interested in better library service in their communities.

The present program of the Prince George's County Library is based on the findings of the project.

Among these are the following items of interest: (1) Rural people spend

nearly twice as much time listening to the radio as in reading. (2) About one-fifth of the rural population borrow books, but the borrowing rate for rural non-farmers is about twice that of farmers. (3) About one-fifth of the rural population uses Agricultural College publications. Twice as many farmers as rural non-farmers use them. Nearly one-half of the farm operators and managers use them. (4) In the rural population newspapers are read most, books second and magazines third. (5) Books are read mainly for fiction whereas magazines are read primarily for non-fiction. (6) Approximately 5 percent of the rural population borrows books from commercial lending libraries.

Soil Conservation Research

Report on cooperative projects between the U. S. Department of Agriculture, Soil Conservation Service, Division of Research, and the Maryland Agricultural Experiment Station, College Park, Maryland, for the year ending June 30, 1951.

Ridge Rows Versus Flat Rows Tested

Ridge row culture continued to give good results under a variety of weather conditions. In unusually wet seasons, plots with ridge rows have given much better crops of tobacco and corn, while in dry seasons, there has been no difference in yields.

Three tobacco farmers continued to cooperate in farm trials to test the use of ridge rows combined with terraces and waterways to control erosion in tobacco fields. The results have been favorable and these farmers are convinced that ridge rows give excellent erosion control while growing good crops of tobacco. Other farmers are showing interest in this method and are getting the necessary waterways and terraces prepared so that ridge rows can be installed in the near future.

Winter Cover Crop Management

In 1950, following 6 years of study, outstanding yields of tobacco were obtained following the delayed turning of good cover crop mixtures. Tobacco grown following early or normal turning under of vetch grown in mixtures with wheat, rye, or ryegrass gave an increase of 230 pounds of tobacco per acre compared with tobacco grown following ryegrass alone. By turning under these cover crop mixtures one month later, an additional 199 pounds per acre was added to the yield of the tobacco crop. The delayed turning of ryegrass alone gave only a slight increase in yield.

Plots that had vetch alone continued to give fair yields of poor quality tobacco while plots with no cover gave very poor yields. The delayed turning of the mixtures gave over 500 pounds more tobacco than the plots with no cover. These tests are being conducted on a light tobacco soil.



This tobacco field was severely damaged by a flash rain. Compare this with the field below.

This ridged tobacco field gives excellent erosion control. Notice the coarse organic matter that is mixed with the soil



Publications

Bulletins

- A56. Community Aspects of Library Planning. R. E. Galloway, P. M. Houser and H. Hoffsommer. 32 pp. March, 1951.
- A57. The Del-Mar-Va Broiler Industry. J. M. Gwin. 36 pp. December, 1950.
- A58. Farm Practices Affecting Seasonal Milk Production in the Baltimore Milkshed. D. J. Burns and G. M. Beal. 16 pp. October, 1950.
- A59. Local Rural Road Problems in Maryland. W. P. Walker and P. R. Poffenberger. 24 pp. October, 1950.
- A60. One Hundred Questions and Answers on Liming Land. J. H. Axley, R. P. Thomas, J. H. Hoyert and E. Strickling. 32 pp. March, 1951.
- A61. Local Rural Road Use and Benefits in Maryland. W. P. Walker and S. H. DeVault. 28 pp. November, 1950.
- A62. Agricultural Progress Through Research . . . 63rd Annual Report. Year ending June 30, 1950. W. B. Kemp. 44 pp.

Scientific Journal Articles and Miscellaneous Periodicals, Reports, Proceedings, etc.

Department of Agricultural Economics

100. Rural Tax Problems in Montgomery County, Maryland. W. P. Walker and F. E. Hulse. (*Mimeographed Circular*) 16 pp. December, 1950.
107. Economics of Soil Conservation in the Harford County Soil Conservation District in Maryland. R. Risa and M. Larsen. (*Mimeographed Circular*) 30 pp. April, 1951.
108. Volume of Fruits and Vegetables Handled in Baltimore. S. C. Shull. (*Lithographed Circular*) 38 pp. April, 1951.

Department of Agronomy

- A321. Influence of Liming Materials on the Soil Reaction of Six Prominent Maryland Soils. J. H. Hoyert and J. H. Axley. *Soil Sci.* (In press)
101. The Performance of Hybrid Corn in 1950. R. G. Rothgeb. (*Planographed Circular*) 16 pp. February, 1951.
104. A Method of Estimating the Reacting Rate of Different Particle Sizes of Limestone. R. P. Thomas and H. M. Gross. *Soil Sci.* (In press)
106. Sweet Corn Field Trials of 1950. R. G. Rothgeb. (*Mimeographed Circular*) 8 pp. February, 1951.

Department of Animal Husbandry

- A293. Use of a Slightly Modified Connecticut Broiler Ration for Swine. W. W. Green, J. C. Shaw, J. L. Carmon, H. L. Stier and M. H. Kerr. *Feedstuffs* 22(38):22-24. September, 1950. (In cooperation with the Department of Dairy Husbandry)

Department of Botany

- A309. Polyembryony in *Zea mays* and *Lilium regale* following X-irradiation of the Pollen. D. T. Morgan, Jr., and R. D. Rappleye. *Journal of Heredity* XLII(2): 90-93. March-April, 1951.
- A317. Spot Anthracnose Known in Maryland and Its Distribution by Counties. R. A. Jehle, Anna E. Jenkins and W. F. Jeffers. *Plant Disease Repr.* 35(4):194-199. April, 1951.

- A326. Early Home-Grown Seed for Planting the Late Potato Crop in Maryland. R. A. Jehle, C. E. Cox and J. E. Moore. *Am. Pot. Jour.* (In press)
- A329. Identity of Gaseous Toxicants from Organic Sulfur Fungicides. C. E. Cox, H. D. Sisler and R. A. Spurr. (In press)
102. Spraying Peppers for Disease Control in Maryland. C. E. Cox. *Trans. Peninsula Hort. Soc.* 40(5):79-81. 1950.
103. Results of Tomato Spray Plot at Salisbury—1950. J. E. Moore and C. E. Cox. *Trans. Peninsula Hort. Soc.* 40(5):81-83. 1950.

Department of Dairy Husbandry

- A292. Effect of High Temperature Heat Treatment of Milk on the Ammonia Content. P. Stroglyi, I. A. Gould and B. C. Johnson. *Jour. Dairy Sci.* 34(3):219-223. March, 1951.
- A294. The Effect of Raw Soybeans on Blood Plasma Carotene and Vitamin A and Liver Vitamin A of Calves. J. C. Shaw, L. A. Moore and J. F. Sykes. *Jour. Dairy Sci.* 34(3):176-180. March, 1951.
- A297. An Approach to the Etiology of Ketosis in Dairy Cows. J. C. Shaw, B. C. Hatzios and E. C. Leffel. *Proc. Book Amer. Vet. Med. Assoc.* 73-75. August, 1950.
- A322. Net Energy vs. T. D. N. in Evaluating the Efficacy of an All-Alfalfa Hay Ration for Milk Production. H. M. Irvin, J. C. Shaw, P. Saarinen and L. S. Moore. *Jour. Animal Sci.* (In press)

Department of Entomology

- A301. On Control of the Mexican Bean Beetle. L. P. Ditman and W. E. Bickley. *Jour. Econ. Entom.* 44(3):325-328. June, 1951
- A305. Corn Earworm Control. L. P. Ditman. *Trans. Peninsula Hort. Soc.* 40:58-61. 1951.
- A308. Chemical Methods for Controlling the Mexican Bean Beetle. L. P. Ditman and W. E. Bickley. *Amer. Fert. and Allied Chem.* 114(3):35-38. Mar. 1951.
- A315. Ten Case Increase Possible by Spraying Sweet Corn Insects. L. P. Ditman. *Food Packer* 32(5):57-59. May, 1951.
- A318. How Cannerns Can Control Corn Earworm with Spray Boom, DDT. L. P. Ditman. *Food Packer* 32(7):34-36. July, 1951.
- A319. Insecticide Tests Against the Potato Tuberworm. G. W. Lloyd. *Jour. Econ. Entom.* 44(4):613. August, 1951.
- A320. Timing Treatments for European Corn Borer Control. L. P. Ditman and G. W. Lloyd. *Jour. Econ. Entom.* 44(4):564:566. August, 1951.

Department of Horticulture

- A299. Physiological Studies of Prepackaged Cut Flowers. J. E. Hawes and C. B. Link. *Proc. Amer. Soc. Hort. Sci.* (In press)
- A300. Nutrient Deficiency Symptoms and Leaf Analysis of Azaleas Grown in Sand Culture. M. C. Twigg and C. B. Link. *Proc. Amer. Soc. Hort. Sci.* (In press)
- A303. Rooting Response of Geranium (*Pelargonium hortorum*, Bailey var. Ricard) Cuttings as Influenced by Nitrogen, Phosphorus and Potassium Nutrition of the Stock Plant. J. R. Haun and P. W. Cornell. *Proc. Amer. Soc. Hort. Sci.* (In press)
- A304. Additional Experiments on the Mineral Nutrition of Hydrangeas. J. B. Shanks and C. B. Link. *Proc. Amer. Soc. Hort. Sci.* (In press)
- A306. The Shear-Press, an Instrument for Measuring Quality of Foods. A. Kramer, G. J. Burkhardt and H. P. Rogers. *The Canner* 112(5):34-36,40. February, 1951. (In cooperation with Department of Agricultural Engineering)
- A307. The Shear-Press, an Instrument for Measuring Quality of Foods. II. Application to Lima Beans. A. Kramer, K. Aamlid and R. B. Guyer. *Food Eng.* 23(4):112-113, 187. April, 1951.

- A310. Yield and Canning Tests with a Dark Green Alaska Pea. E. P. Walls and F. C. Stark. *Food Packer* 32(2):64-68. February, 1951.
- A312. Some Studies on the Effects of Temperature and Photo-period on Growth and Flower Formation in Hydrangea. J. B. Shanks and C. B. Link. *Proc. Amer. Soc. Hort. Sci.* (In press)
- A313. Objective Measurements of Quality of Raw and Processed Snap Beans as Affected by Maleic Hydrazide and Para-Chlorophenoxyacetic Acid. R. B. Guyer and A. Kramer. *Proc. Amer. Soc. Hort. Sci.* (In press)
- A316. Effect of State of Ripeness on Yield of Tomatoes for the Fresh Market and Processing. A. Kramer, L. E. Scott, E. D. Giggard and L. E. Ide. *Trans. Peninsular Hort. Soc.* (In press)
99. Effect of a Spray Schedule on Yield and Quality of Processed Tomato Products. E. Giggard, C. E. Cox and A. Kramer. *Food Packer* 31(13). December, 1950. (In cooperation with the Department of Botany.)
105. Nutrient Deficiency Symptoms of Azaleas. M. C. Twigg and C. B. Link. *So. Flor. & Nurseryman* 96-97. April, 1951. *Ohio Flor. Bul. No. 259.* April, 1951. *Flor. Rev. Exch.* 116(15):13. April, 1951.
109. Progress Report on Sweet Potato Cracking Experiments. L. E. Scott, F. C. Stark, W. A. Matthews, A. A. El-Kattan and W. L. Ogle. *Proc. Md. Veg. Grow. Assoc.* (In press)
110. Objective Testing of Vegetable Quality. Amihud Kramer. *Food Technol.* 5(7): 265-269. July, 1951.

Department of Poultry Husbandry

- A287. Action of Vitamin B₁₂ in Counteracting Glycine Toxicity in the Chick. H. Menge and G. F. Combs. *Proc. Soc. Exp. Biol. & Med.* 75(1):139-142. October, 1950.
- A289. Non-Effect of a Growth Hormone Preparation in the Regenerating Feather. Mary Juhn. *Proc. Soc. Exp. Biol. & Med.* 76(1):118-120. January, 1951.
- A290. A Genetic Response to Induced Goiter in Chickens. C. S. Shaffner and H. M. El-Ibiary. *J. Heredity* 41(9):246-247. September, 1950.
- A291. Lethal Internal Temperatures for the Chicken, from Fertile Egg to Mature Bird. R. E. Moreng and C. S. Shaffner. *Poultry Sci.* 30(2):255-266. March, 1951.
- A298. The Effect of Induced Hypothyroidism on the Genetics of Growth in the Chicken. H. M. El-Ibiary and C. S. Shaffner. *Poultry Sci.* 30(3):435-444. May, 1951.
- A302. Effect of Yolk Removal in Day-Old Chicks on Early Nutritional Requirements. H. Menge, R. E. Moreng and G. F. Combs. *Proc. Soc. Exp. Biol. & Med.* 76(1):46-49. January, 1951.
- A311. Unidentified Factors Required for Chick Growth. G. F. Combs. *Proc. World Poultry Cong.* (In press)
- A314. Feed Efficiency of Broilers as Influenced by Mild Hypothyroidism. C. S. Shaffner. *Proc. World Poultry Cong.* (In press)
- A323. The Effect of Temperature and Time of Storage on the Fertilizing Capacity of Undiluted Fowl Semen. C. S. Shaffner. *Poultry Sci.* (In press)
- A324. A Comparison of Spur Growth in the Cockerel, Slip and Capon. G. D. Quigley and Mary Juhn. *Poultry Sci.* (In press)
- A328. Effect on Chick Growth of Amino Acid Imbalances in Diets Containing Low and Adequate Levels of Niacin and Pyridoxin. J. O. Anderson, G. F. Combs, A. C. Groschke and G. M. Briggs. *J. Nutrition.* (In press)
- A330. Unidentified Growth Factors Required by Chicks and Poults. I. Studies with Chicks Using Purified Diets. H. Menge, G. F. Combs, Peng-Tung Hsu and Mary S. Shorb. *Poultry Sci.* (In press)

Current Projects

Agricultural Economics and Marketing

(These are projects and not publications available to the public.)

Project No.

- A-18-x Father-Son Partnership Arrangements in Maryland
- A-18-aa Insurance Coverage Carried by Farmers.
- A-18-ab Economics of Soil Conservation in the Harford County Soil Conservation District of Maryland
- A-18-ac Farming Alternatives in Major Competing Potato Areas.
- A-18-ad Factors Affecting Efficiency in Milk Production.
- A-18-ae Organization and Operation of Representative Types of Farms in Maryland.
- A-18-af An Economic Study of Dairy Farms in Maryland.
- A-19-i Improving Farm Building Assessments for Tax Purposes.
- A-19-j Sales Taxes and Their Application to Farmers.
- A-19-k Recent Tax Changes in Maryland and Their Effect on Farmers' Tax Obligations.
- A-19-l Financial Status and Security of Farmers.
- A-19-m Rural Cooperative Credit.
- A-26-l Prices Paid by Farmers for Commodities Bought.
- A-26-p Economic Aspects of Marketing Fresh Fruits and Vegetables in Consumer Packages.
- A-26-q Marketing Premium Sweet Corn Direct from Grower to Retailer.
- A-26-r Retail Merchandising Practices and Display Methods.
- A-26-s-2 Improving the Marketing of Maryland Cantaloupes.
- A-26-s-3 Marketing and Distribution of Maryland Wheat.
- A-26-t Seasonal and Supplementary Supply Sources and Variations in the Major Fluid Milk Sheds of Maryland.
- A-26-v Effect of Methods of Marketing Eggs on Quality During the Summer Months.
- A-26-w Increased Consumption of, and Lower Marketing Costs for Apples and Peaches Through Adoption of Better Distribution Practices.
- A-26-y Pricing Policy for Fruits and Vegetables in Retail Stores.
- A-26-aa Relation of Various Egg Marketing Methods to Producer Returns in Maryland.
- A-26-ab The Marketing and Distribution of Maryland Canned Vegetables.
- A-26-ac Reducing Costs, Determining and Maintaining Quality, Increasing Efficiency in Marketing Maryland Poultry Products.
- A-32-f Farm Tenancy and Leasing Arrangements in Maryland.
- A-32-h The Effect of Drainage Upon Crop Yields, Farming Practices and Land Utilization.
- A-32-i Rural Zoning in Maryland.

Agricultural Education

Project No.

- T-1 Possibilities of Education with Adult Farmers.

Agricultural Engineering

Project No.

- R-10 Drying Hay with Heated Air.
- R-11-c Mechanization of Tobacco Production.
- R-11-d Tobacco Housing.

- R-11-e Structures and Equipment for Tobacco Stripping.
- R-12 Drying Ear Corn with Natural Air in Maryland.
- R-13 Development of Equipment for Field Application of Insecticides to Canning Corn for Control of the European Corn Borer.
- R-14 Mow Curing Hay in Maryland.

Agronomy

Project No.

- B-39 Wheat—Hybridization and Selection.
- B-41 Barley—Hybridization for Smooth Awns.
- B-43 Soybean Production in Maryland.
- B-44 Sweet Corn Improvement.
- B-50 Improvement of Dent Corn.
- B-52 Effects of Different Short Rotations on Physical, Chemical and Pathological Conditions in the Soil and on Crop Production.
- B-53 Curing of Maryland Tobacco.
- B-56-a Improvement of Red Clover Adapted to Maryland.
- B-56-b Pasture Renovation Studies.
- B-56-c Management of Medium Red Clover Stands After Combined Wheat.
- B-56-d Alfalfa Strain and Variety Evaluation.
- B-56-e Red Clover Strain and Variety Evaluation.
- B-56-f The Evaluation of Forage Crop Varieties and Strains for their Use and Adaptation in Maryland.
- B-56-g Development and Maintenance of Superior Ladino Clover Breeding Material.
- B-56-h Survey of Pasture Conditions in Maryland.
- B-56-i Orchard Grass Breeding.
- B-56-j Grass and Legume Combinations for Beef Production.
- B-57 The Improvement, Production and Use of Rye in Maryland.
- B-58-a Control of Weeds in Corn by the Use of 2,4-D Preparations.
- B-58-b Control of Weeds in Legumes.
- B-59 Improvement in Plant Bed Management for Maryland Tobacco.
- B-60 Study of Placement of Fertilizers for Maryland Tobacco.
- O-27 Field Studies of the Fertilizer Requirements and Management of Important Soil Types in Maryland.
- O-28-b A Study of the Formula and Analysis for Late Potatoes.
- O-43 Hydrologic Studies with Reference to Soil Moisture Conservation, Soil Fertility and Flood Control.
- O-44 A Bio-Chemical Biological Study of Means to Increase the Organic Colloidal Complex of the Soil.
- O-44-a A Study of the Chemical and Physical Changes Produced in a Soil by the Formation of the Organic Colloidal Complex.
- O-45-a Soil Fertility Studies at the University Farms.
- O-45-b A Study of the Availability of Phosphate Material.
- O-47-a A Study of the Lime Needs and Reactions in Maryland Soils.
- O-47-b A Study of Neutralization Value of Slag for Maryland Soils.
- O-48 A Study of the Reclassification of Soils and the Adaptation of These Classes to Soil Conservation Work in Maryland.
- O-49 A Study of the Effect of Fertilizer, Boron, Minor Elements on the Stand, Yield and Composition of Alfalfa.
- O-50 Moisture Studies.
- O-51 Alfalfa Fertility Studies.

Agronomy—Seed Inspection

Project No.

- N-7 Inspection of Seeds Sold Throughout the State.
- N-8 Examination of Samples from Seeds Sold Throughout the State.
- N-9 Examination of Samples Submitted to the Laboratory.

Animal Husbandry

Project No.

- C-6 Study of the Factors Which Influence the Production of Cured Pork Products of Desirable Quality and Palatability. A Study of Methods of Injection for the Quick Curing of Hams.
- C-8 Swine Breeding Investigations Within the State of Maryland.
- C-14 A Study of the Productiveness of Purebred Beef Cattle in Maryland.
- C-14-a Effect of Early Weaning on the Duration of Maternal Influences in Beef Cattle.
- C-14-b Type Classification as an Aid in Selection of Beef Breeding Cattle.
- C-14-c Studies on Bodily Conformation and the Correlations Between Live Animals Measurements and the Weight and Other Characteristics of Carcasses and of Wholesale Cuts in Beef Animals.
- C-15 Influence of Diet on Ketosis in Sheep.
- C-16 Histological Study of the Development of the Testes of the Ram.
- C-17 Effect of New Feeding and Management Practices on Market Classification and Consumer Desirability of Farm Animals and Their Products.
- C-18 A Study of the Causes and Prevention of Bloat in Beef Cattle on Pasture.
- C-19 A Study of the Chromosomes of Farm Animals.

Animal Pathology

Project No.

- D-46 Bang's Disease—Calfhood Vaccination.
- D-50 Anaplasmosis of Cattle.
- D-51 Experiments with Infectious Enterohepatitis (Blackhead) of Turkeys.
- D-52 Newcastle Disease Investigations with Particular Reference to Vaccine Modifications and Virus Study.
- D-53 Role of Disturbances in the Acid-Base Balance in the Parturient Cow and Their Significance in the Cause of Milk Fever and Ketosis (Acetonemia).
- D-54 A Study of the Infectious Bovine Mastitis; Its Control and Eradication and the Economic Losses Attending.

Botany

Project No.

- F-9 Cytogenetic Studies in the Genera *Ipomoea*, *Gladiolus* and *Tulipa*.
- F-12 The Native Plants of Maryland, Their Occurrence, Distribution and Economic Importance.
- F-15 The Production of Homozygous Strains of Some Maryland Crop Plants Utilizing the Twin Seedling Haploid Technique; to Study Heterosis in F_1 Hybrids.
- F-15-a Heterosis in Hybrids from Homozygous Lines Obtained from Haploid Plants.
- J-72 Potato Improvement and Disease Control.
- J-78-a Breeding Strawberries for Resistance to the Red Stele Disease Caused by *Phytophthora fragariae* Hickman.
- J-80-a Disease Resistance in Potatoes with Special Reference to Wilt and Late Blight.
- J-85 The Effect of Hormone and Chemical Treatments on Breaking the Rest Period of Seed Potatoes.
- J-86-a Methods of Controlling Diseases Affecting Commercial Production of Sweet Potatoes in Maryland.
- J-87 Treatments for Control of Seed and Soil-Borne Disease of Vegetable Crops.
- J-88 Development of Identification and Control Procedures for Plant Virus Diseases in Maryland.
- J-89 Development of Improved Strains of Maryland Tobacco Resistant to Diseases.
- K-7 Physiological and Biochemical Aspects of Vegetable Storage.
- K-8-a Relationship of Boron to the Flowering and Fruiting of Plants.
- K-8-b A Determination of the Concentrations of Various Inorganic and Organic Components Coincident with Maximal Yields of Certain Crop Plants in Maryland.

Dairy Husbandry

Project No.

- G-27-a The Effect of Certain Feed Stuff's Upon the Vitamin A Requirements of Dairy Cattle.
- G-34 Chemical Changes in Milk Fat as Related to the Flavor of the Milk.
- G-35 The Analysis of Dairy Products.
- G-37 The Feeding and Management of the Cow During the Dry and Freshening Period.
- G-38 The Fat Metabolism of the Mammary Gland.
- G-39 Factors that Affect the Availability of Nutrients in Feeds and Their Influence Upon Blood Composition and Milk Secretion.
- G-40 The Influence of High Temperature Heat Treatments on Certain Physical and Chemical Properties of Milk.
- G-41 The Effect of Feeding High Energy Diets During the Freshening Period.
- G-42 Methods of Processing and Other Factors Affecting the Quality of Ice Cream.
- G-43 The Metabolism of Acetate, B-hydroxybutyric Acid, Glucose and Other Carbon Compounds in Lactating Ruminants.

Entomology

Project No.

- H-29-6 Investigations of the Biology and Control of Insects Affecting Canning Crops.
Sub. 6. The Pea Aphid. Insecticidal Control and Timing Treatments.
- H-29-G *Sub. G.* Insecticidal Control of the Mexican Bean Beetle.
- H-35 Nursery Insects.
- H-40 Biology and Control of Tobacco Insects.
Sub. 1. The Tobacco Horn Worms.
- H-43 The Biology and Control of the European Corn Borer Under Maryland Conditions.
- H-46-a Concentrated Sprays. The Development of Liquefied Gas Insecticide Aerosols and Machinery for Their Application.
- H-46-b Concentrated Sprays. Combined Insecticidal and Fungicidal Aerosols.
- H-48 The Codling Moth.
- H-50 The Biology and Control of the Pests of Commercial Floriculture.
- H-51 The Effect of DDT on Aquatic Life.
- H-53 Nectar Resources of Maryland.
- H-54 A Monographic Study of the Coccid Family Acleridae (order Homoptera).
- H-55-a The Control of Insects Attacking Peach Foliage and Fruit.
- H-55-b Control of the Peach Tree Borer.
- H-56 Patuxent Project on the Effect of Soil Conservation Upon Insect Populations.
- H-57 Relation of Insect Injury to Yellowing and Decline of Alfalfa.

Horticulture

Project No.

- I-26-a Rooting of Ornamental Plants Difficult to Propagate.
- I-58-a A Physiological Study of the Keeping Qualities of Cut Flowers as Influenced by Packaging.
- I-74-a Effect of Environmental Factors and Cultural Practices on the Growth and Flowering of Hydrangeas and Azaleas.
- I-79-a The Mineral Nutrient Requirements of the Azalea.
- I-79-b The Mineral Nutrition of the Hydrangea.
- L-58-g Determination of Varietal Adaptability of Maryland Grown Apples to Making of Canned and Frozen Concentrates and Development of Improved Methods of Preparation.
- L-73 Adaptation of Fruit Varieties and New Seedlings to Maryland.

- L-74 Environmental Factors and Cultural Practices in Relation to the Growth and Fruiting Responses of Fruits.
- L-74-a Relation of Environmental and Soil Factors to the Cracking of Sweet Potatoes.
- L-79-a Mineral Nutrition of the Strawberry with Particular Reference to Effects of Calcium, Potassium and Magnesium on Growth and Fruiting.
- Q-58-f Develop Objective and Easily Applied Measures of Quality Factors Involved in Market Grades and Standards.
- Q-58-h Development of Methods of Preparation of Canned and Frozen Tomato Concentrates.
- Q-67 The Value of Organic Matter in the Production of Vegetables Crops.
- Q-74 A Study of Regional Adaptation of Certain Vegetable Crops and Varieties in Maryland.
- Q-77 Crop Management Studies with Vegetable Crops.
- Q-79-b The Mineral Levels and Interrelationships of Mineral Nutrients in Fruit Plantings of Maryland.
- Q-79-c Influence of Nutrient Intensity and Balance on the Quality and Physiological Defoliation of Cantaloupes.
- Q-79-e Influence of Nutrient Intensity and Balance Upon the Yield and Quality of Tomatoes.
- Q-79-f Mineral Nutrition of the Sweet Potato with Special Reference to Cation Interrelationships.
- Q-81 Cantaloupe Breeding and Selection with Particular Reference to Quality and Resistance to Defoliation.
- Q-82 Tomato Breeding and Selection with Particular Reference to Greater Resistance to Cracking and to Late Blight.

Poultry Husbandry

Project No.

- M-32-k Difference in Thyroid Activity as Related to Strain Differences in Growth, Feed Utilization and Feathering.
- M-33-f Changes in Grades of Eggs in Carlot Shipments in Relation to Season, Shipping Distance, Temperature, Time and Other Factors.
- M-33-h Hormonal Control of Economic Traits in Poultry.
- M-33-i Development of a Flightless Strain of New Hampshire Chickens.
- M-33-j Semen Studies with Chickens and Turkeys.
- M-34-e Medium Sized Strain of Turkeys with Certain Desirable Qualities.
- M-35-g The Requirements of the Growing Chick for Newer Members of the Vitamin B Complex.
- M-35-i Amino Acids in Poultry Nutrition.
- M-35-k Unidentified Growth Factors for Chickens and Bacteria.
- M-44 The Influence of Methods of Dressing and Holding on the Quality of Poultry Meat.
- M-45 New Studies on the Causative Effects of Wheat in Pullet Disease.

Sociology

Project No.

- S-1 Community and Population Bases in Planning County Library Services

Changes In Personnel

Appointments

EDGAR CORBIN, M.S., Instructor, Dairy Husbandry, February 1, 1951.
W. M. DUGGER, Ph.D., Assistant Professor, Botany, July 1, 1950
MARK KEENEY, Ph.D., Assistant Professor, Dairy Manufacturing, July 1, 1950
R. T. PRESTON, B.S., Assistant, Agronomy, August 15, 1950

Resignations

B. B. BARGER, B.S., Assistant, Agronomy, August 9, 1950
J. M. GWIN, Ph.D., Professor, Poultry Husbandry, November 1, 1950
J. E. HAWES, M.S., Instructor, Horticulture, March 15, 1951
L. E. HOGUE, B.S., Instructor, Agronomy, April 4, 1951
J. A. HOLTER, B.S., Instructor, Dairy Husbandry, September 30, 1950
EMORY LEFFEL, M.S., Instructor, Dairy Husbandry, November 20, 1950
G. W. LLOYD, M.S., Instructor, Entomology, April 30, 1951
J. F. MATTICK, Ph.D., Associate Professor, Dairy Husbandry, May 19, 1951
ANNA B. OWENS, M.S., Instructor, Botany, January 31, 1951

Station Staff

I. C. HAUT, *Director*

AGRICULTURAL ECONOMICS

S. H. DeVault, Ph.D., Prof. and Head of Dept.
G. M. Beal, Ph.D., Professor, Agr. Econ.
L. B. Bohanan, M.S., Asst. Prof. Agr. Econ.
A. B. Hamilton, M.S., Assoc. Prof. Agr. Econ.
P. R. Poffenberger, M.S., Assoc. Prof. Agr. Econ.
S. C. Shull, M.S., Assoc. Prof. Agr. Econ.
W. T. Sigafosse, B.S., Res. Asst.
H. D. Smith, M.S., Asst. Prof. Agr. Econ.
W. P. Walker, M.S., Prof. Agr. Econ.

AGRICULTURAL EDUCATION

A. M. Ahalt, M.S., Prof. and Head of Dept.
R. A. Murray, Ph.D., Assoc. Prof.

AGRICULTURAL ENGINEERING

R. W. Carpenter, A.B., LL.B., Prof. and Head of Dept.
G. J. Burkhardt, M.S., Assoc. Prof. Agr. Engr.
H. J. Hoffmeister, B.S., Asst. Prof. Agr. Engr.
A. V. Krewatch, M.S., Assoc. Prof. Agr. Engr.
P. N. Winn, Jr., B.S., Asst. Prof. Agr. Engr.

AGRONOMY

A. O. Kuhn, Ph.D., Prof. and Head of Dept.
J. H. Axley, Ph.D., Assoc. Prof. Soils
R. T. Preston, B.S., Asst. Tobacco
A. W. Burger, Ph.D., Assoc. Prof.
L. E. Hogue, B.S., Instr. Agron.
C. H. Liden, M.S., Asst. Prof. Agron.
J. L. Newcomer, B.S., Instr.
W. B. Posey, M.S., Prof. Tobacco
T. S. Ronningen, Ph.D., Asst. Prof. Agron.
R. G. Rothgeb, Ph.D., Prof. Agron.
O. E. Street, Ph.D., Assoc. Prof. Tobacco
H. B. Winant, M.S., Asst. Prof. Soils

ANIMAL HUSBANDRY

J. E. Foster, Ph.D., Prof. and Head of Dept.
John Buric, B.S., Instr. Animal Husbandry
W. W. Green, Ph.D., Prof. Animal Husb.
M. H. Kerr, M.S., Assoc. Prof. Animal Husb.
J. B. Outhouse, M.S., Assoc. Prof. Animal Husb.

ANIMAL PATHOLOGY

A. L. Brueckner, B.S., D.V.M., Prof. and Head of Dept.
Cornelia M. Cotton, Ph.D., Coop. Agent
H. M. DeVolt, M.S., D.V.M., Prof. Path.
L. J. Poelma, M.S., D.V.M., Prof. Path.
R. E. Swope, V.M.D., Assoc. Prof.

BOTANY

Ronald Bamford, Ph.D., Prof. and Head of Dept.
R. G. Brown, Ph.D., Assoc. Prof. Bot.

G. E. Cox, Ph.D., Prof. Plt. Path.
H. G. Gauch, Ph.D., Prof. Plt. Phys.
W. M. Dugger, Ph.D., Asst. Prof., Plt. Physiol
W. F. Jeffers, Ph.D., Prof. Plt. Path.
R. A. Jehle, Ph.D., Prof. Plt. Path.
J. E. Moore, B.S., Instr. Plt. Path.
D. T. Morgan, Jr., Ph.D., Asst. Prof. Botany
O. D. Morgan, Ph.D., Asst. Prof.
R. D. Rappleye, Ph.D., Asst. Prof. Botany
L. O. Weaver, Ph.D., Asst. Prof. Botany

DAIRY HUSBANDRY

G. M. Cairns, Ph.D., Prof. and Head of Dept.
W. S. Arbuckle, Ph.D., Professor
Edgar Corbin, M.S., Instr. Dairy Husb.
M. F. Ellmore, B.S., Instr. Dairy Husb.
Mark Keeney, Ph.D., Asst. Prof. Dairy Mfg.
J. C. Shaw, Ph.D., Prof. Dairy Husb.
R. E. Stout, B.S., Asst. Insp. Dairy Husb.

EDITORIAL

A. E. Durfee, M.S., Prof. and Editor
J. C. Evans, B.S., Assoc. Prof.

ENTOMOLOGY

E. N. Cory, Ph.D., Prof. and Head of Dept.
G. J. Abrams, M.S., Asst. Prof. Apiculture
W. E. Bickley, Ph.D., Assoc. Prof.
L. P. Ditman, Ph.D., Assoc. Prof. Ent.
Elizabeth Haviland, Ph.D., Asst. Prof.
H. S. McConnell, M.S., Assoc. Prof. Ent.

HORTICULTURE

I. C. Haut, Ph.D., Prof. and Head of Dept.
J. S. Caldwell, Ph.D., Assoc. Prof.
P. W. Cornell, M.S., Assoc. Prof. Flor.
A. A. Duncan, B.S., Res. Asst. Hort.
Amihud Kramer, Ph.D., Prof. Hort.
C. B. Link, Ph.D., Prof. Flor.
W. A. Matthews, M.S., Assoc. Prof.
L. E. Scott, Ph.D., Prof. Physiol.
J. B. Shanks, Ph.D., Assoc. Prof.
F. C. Stark, Ph.D., Assoc. Prof.
S. H. Todd, B.S., Asst. Hort.
E. P. Walls, Ph.D., Prof. Canning Crops

POULTRY

M. A. Jull, Ph.D., Prof. and Head of Dept.
G. F. Combs, Ph.D., Prof. Poultry Nutrition
Mary Juhn, Ph.D., Res. Prof.
G. D. Quigley, B.S., Assoc. Prof. Poultry Husb.
C. S. Shaffner, Ph.D., Prof. Poultry Husb.
Mary Shorb, Ph.D., Prof.

SEED INSPECTION

F. S. Holmes, M.S., Chief Seed Inspector

Financial Statement -- July 1, 1950 to June 30, 1951

FEDERAL FUNDS

	Hatch	Adams	Purnell	Bankhead-Jones	Research Marketing			For Agr. Investigations *
					9b1-9b2	9b3	Title II	
Appropriation 1950-51	\$15,000.00	\$15,000.00	\$60,000.00	\$ 5.27 35,297.74	\$ 3,950.83 46,055.54	\$ 960.20 17,765.00	\$ 102.15 7,000.00	
Receipts from sources other than Federal 1950-51	\$15,000.00	\$15,000.00	\$60,000.00	\$35,303.01	\$50,006.37	\$18,725.20	\$7,102.15	
State Appropriations for Agricultural Investigations.....								\$295,862.00
Industrial Grants								42,481.00
Sales and Miscellaneous.....								108,185.99
Balance brought forward July 1, 1950.....								\$446,528.99
Total								\$535,325.09
Expenditures:								
Personal Services	6,501.42	13,718.00	50,105.54	24,085.98	35,266.97	6,961.25	5,280.06	242,651.29
Travel	4,153.73	80.81	604.91	391.26	1,214.53	2,268.65	622.66	11,176.13
Transportation			4.82	4.12	1.65	22.18		405.02
Communication Service	34.05		74.52	96.81	59.74	11.00		1,436.53
Rents and Utility Services	17.97		16.09	80.40	132.30	32.62		1,367.21
Printing and Binding.....	968.59		75	2.48		27.59		3,724.14
Other Contractual Services.....	119.76		458.52	977.24	695.72	1,046.62		18,842.08
Supplies and Materials.....	2,230.95	608.25	6,057.15	8,041.49	5,147.45	5,135.82	74.05	106,815.82
Equipment	806.20	592.94	2,430.20	1,623.23	924.37	2,064.51	30.00	35,543.19
Land and Structures	166.07		247.50		339.35	87.40		2,586.91
Contributions to Retirement.....								
Balances June 30, 1951.....	\$14,998.74 1.26	\$15,000.00	\$60,000.00	\$35,303.01	\$43,782.08 6,224.29	\$17,657.64 1,067.56	\$6,006.77 1,095.38	\$424,548.32 110,776.77
Totals	\$15,000.00	\$15,000.00	\$60,000.00	\$35,303.01	\$50,006.37	\$18,725.20	\$7,102.15	\$535,325.09

BOARD OF REGENTS OF THE UNIVERSITY OF MARYLAND AND THE MARYLAND STATE BOARD OF AGRICULTURE

WILLIAM P. COLE, JR., *Chairman*, Baltimore

STANFORD Z. ROTHSCHILD, SR., *Secretary*, Baltimore

J. MILTON PATTERSON, *Treasurer*, Baltimore

MRS. JOHN L. WHITEHURST, Baltimore

B. HERBERT BROWN, JR., Baltimore

ARTHUR O. LOVEJOY, Baltimore

EDWARD F. HOLTER, Middletown

E. PAUL KNOTTS, Denton

CHARLES P. MCCORMICK, Baltimore

HARRY H. NUTTLE, Denton

PHILIP C. TURNER, Parkton

H. C. BYRD, *President and Executive Officer*

Visitors will be welcome at all times, and will be given every opportunity to inspect the work of the Experiment Station in all its departments.

The Bulletins and Reports of the Station will be mailed free of charge to all residents of the state who request them.

Address:

AGRICULTURAL EXPERIMENT STATION
College Park, Maryland

MARYLAND & ~~WILL~~ BOOK ROOM
UNIVERSITY OF MARYLAND LIBRARY
COLLEGE PARK, MD.

DO NOT CIRCULATE

DO  CIRCULATE

